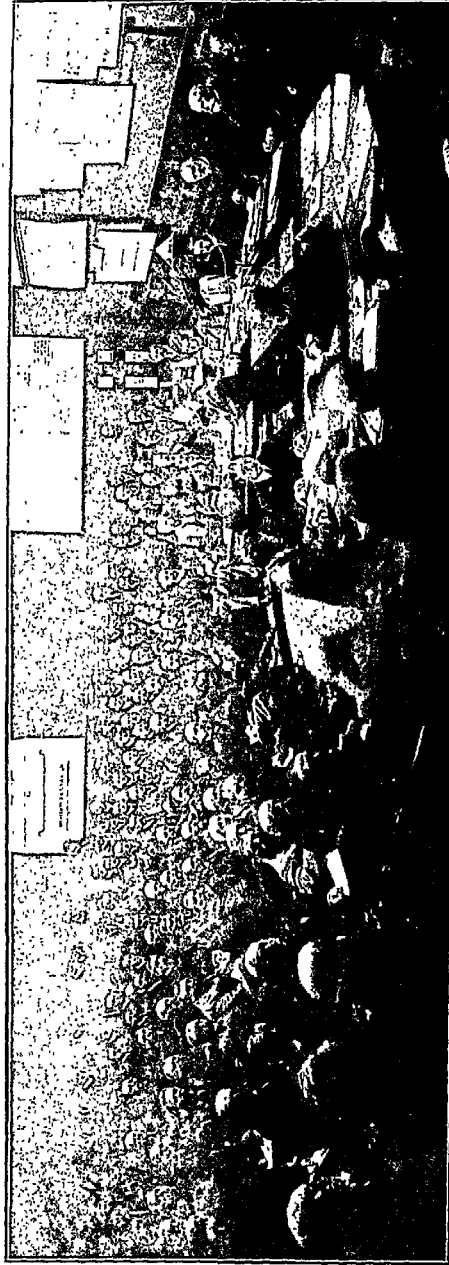


COUNTY COUNCILS ASSOCIATION.



ROAD CONFERENCE

1909.



OPENING MEETING OF THE CONFERENCE.
(FROM A PHOTOGRAPH SUPPLIED BY THE "AUTOMOTOR JOURNAL.")

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COUNTY COUNCILS ASSOCIATION

ROAD CONFERENCE

1909.

CAXTON HOUSE, WESTMINSTER, S.W

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COUNTY COUNCILS ASSOCIATION.

Road Conference.

The Conference on Roads and Motors, held on April 29 and 30 and May 1, 1909, was convened by the County Councils Association. The organisation of the Conference was in the hands of the Highways Committee of that Association, on which were co-opted representatives of the Association of Municipal Corporations, the Urban and Rural District Councils Associations, the Incorporated Association of Municipal and County Engineers, and the County Surveyors Society. A list of the members, both of the Committee and of the Conference itself, is given in Appendix A to this report.

The meetings were held at the Institution of Civil Engineers, the Institution of Mechanical Engineers, and the Surveyors Institution, the halls of which were kindly lent for the purpose.

THURSDAY, APRIL 29.

OPENING MEETING.

PRESIDENT : LORD BELPER.

LORD BELPER said that in taking the chair at that important Conference, which he was very glad to see so well attended, he could assure them it was not his intention to intervene at any great length between them and the questions they had come to discuss. With 40 papers, which they hoped the members would be able to assimilate and digest in the course of the next two days, he was sure it would be quite unjustifiable on his part to add anything to the length of the proceedings. But he would like to take the opportunity as chairman of the executive of the County Councils Association, which had called the Conference together, to state very shortly what their object and intention was in calling the Conference, to indicate in a very few words what the composition and the constitution of the Conference was, and to point out the procedure which they thought it would be convenient to pursue during the continuance of the Conference. With regard to the origin of the Conference, he thought it would be admitted

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that it somewhat arose out of that important conference held in Paris last year. That conference, he believed, was called from every country in the world—at all events all civilised countries—and it was no doubt of a most important character. It was quite evident from the discussions that took place there that every civilised country was suffering in a greater or less degree from the same causes from which we were ourselves suffering as regarded our roads. The coming of the motorcar and the use of engines drawn by machinery to an almost unlimited extent had had such an effect on the roads of this country and other countries in Europe, that it was no wonder serious attention should be called to the matter, and that some solution should be sought for not only to deal with the traffic in a satisfactory manner, but also to alleviate the burdens imposed on the ratepayers. It was natural that any conference which represented a large number of different countries, their roads being managed under different conditions and different authorities, was not likely to come to any very definite conclusion as to what the remedy should be for the serious state of things which he had indicated. In these circumstances it was not unnatural that some of the British representatives at the Paris Conference felt it was desirable to follow that conference up in this country, to strike while the iron was hot, and, if possible, to get together a representative assembly of those interested in the management of the roads in their country, so that if they could not find a solution of their difficulties, discussion at all events might bring them nearer together, while they would be able to point out what direction legislation or any change in the law should take. Let him say at once that he thought this was a convenient time to hold such a conference as this. No doubt for many years after the new system of road management, and especially the establishment of County Councils, was introduced, and while roads under careful management were being greatly improved, there was no very distinctive increase in the general expenditure on the roads, but if they looked at the last five or six years the story was an entirely different one. Whilst the roads, owing to the heavy traffic, had been gradually getting less efficient, and in very many places seriously worse, the expenditure had been steadily growing. He would give them one or two figures—he feared they were rather ancient ones—which were supplied by the Local Government Board. From these it was found that while in the year 1901 the average cost per mile of the roads in England and Wales, including improvements, was £78 a mile, it went up in 1905-6 to £91 and three quarters. That was a very considerable increase in expenditure, but he ventured to say that every gentleman present who was conversant with the state of the roads to-day would be perfectly well aware that from 1905-6 to the present time the increase had been far more rapid. He had no figures from the Local Government Board with regard to last year,

but he could give the figures of his own county, and though they might not be of special value, he thought they would be borne out by the figures of every county in England. From 1891 to 1901 there was no material increase in the cost of the main roads at all. It varied, being sometimes a little up and sometimes down, yet from that time the average cost per mile had gone up from £56. 15s. in 1901 to £78. 10s. 6d. in 1907-8, showing an increase during that time of something like 40 per cent. That indicated what a serious increase there had been all over the country, and with that increase in cost, so far from there being an improvement of the roads, they had been steadily getting worse. If any text was wanted for a conference on the roads it would be found in these few figures, and if any discussion could tend in any way to a solution of the question how the roads could be improved and how the vast expenditure on them could be minimised, they would do a great deal towards relieving a good many people in the country of an uneasy feeling they had got with respect to the management of our roads.

After stating that he would tell them what the object was in calling that Conference. As a County Councils Association they had no particular specific, no particular remedy they wished to force on the attention of the Conference. Their view was that the success of a conference of this sort was impossible unless it combined amongst its members all those who were interested in roads, not only those who used and paid for them and managed them, but those interested in the vehicles which ran on the roads, as well as those interested in the development of the new industry which genius had given us—motorcars and the new machines which carried so much of the heavy traffic of the country. In bringing the Conference together, their wish was that it should be as representative in its character as possible. The list of the bodies invited was rather a long one, but he hoped they would allow him to read it, for he was glad to say they had all accepted. They were the following :

- The Association of County Councils in Scotland.
- The Association of Municipal Corporations.
- The Convention of Royal Burghs.
- The Non-County Boroughs Association.
- The Urban District Councils Association.
- The Rural District Councils Association.
- The Institution of Civil Engineers.
- The Institution of Mechanical Engineers.
- The Surveyors Institution.
- The Society of Engineers.
- The Incorporated Association of Municipal and County Engineers.
- The County Surveyors Society.
- The Institution of Municipal Engineers.

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The Scottish Road Surveyors Association.
The Association of County Surveyors in Ireland.
The Royal Automobile Club and several of its branches.
The Motor Union.
The Scottish Automobile Club.
The Yorkshire Automobile Club.
The Society of Motor Manufacturers and Traders.
The Commercial Motor Users Association.
The National Cyclists Union.
The Roads Improvement Association.
The Highways Protection League.
The Central Chamber of Agriculture.

In addition there were 33 English and Welsh County Councils, 14 Scottish County Councils, and 50 Town Councils. He would add that several of the associations had been good enough to accept the invitation to act on the committee for organising the Conference, which had had laborious duties, and they were very grateful to them for taking part in that work. With regard to procedure, he might say it was not proposed that any resolutions should be passed at the time the papers were taken, but it was suggested that where the chairman and secretaries of each section were clearly of opinion that there was a general consensus of opinion on any particular point, whether in the papers or the views expressed in the discussion, it should be considered whether a resolution should not be put on Saturday, when they met for that purpose, but that any resolution should not be put where it was obvious there was a distinct cleavage of opinion on that particular question. He thought it would be agreed that a catch resolution or vote passed by a haphazard majority would not be of much value. There was only one more point to add. His attention had been called to the fact that the law on highways was not in a very satisfactory condition, in so far that it was contained in a large number of statutes, some overlapping each other, and it was difficult for the uninstructed man to find out how the law stood. He understood that the last consolidation of the law was in 1835—nearly 75 years ago. On this point he might say that there was a very able article in the "Justice of the Peace," written by somebody who appeared to be well cognisant with the subject. That consolidation he referred to was not a complete consolidation, for some of the law of 1775 was still unrepealed. If the result of the Conference led eventually to any legislation or alteration in the law at an early date, it was highly desirable that there should be a codification of the whole of the highway laws, in order that those who run might read, so that people by looking at one Act of Parliament might see what the highway law was. He would conclude his remarks by expressing his pleasure at seeing so large and representative a conference, and a hope that its labours would do something towards the solution of the difficult points they had to discuss. (Applause.)

SECTION A.

CONSTRUCTION AND MAINTENANCE OF ROADS (INCLUDING WEAR AND TEAR, CAMBER, GRADIENTS, WIDTH OF ROADS, PROVISION OF FOOTPATHS, BRIDGES, ETC.).

CHAIRMAN :

COL. G. DIXON.

SECRETARY :

A. G. G. ASHER.

TECHNICAL SECRETARY :

A. DRYLAND.

Papers 9 to 23* were taken as read, as follows :

PAPER 9: BY WILLIAM N. BLAIR, M.INST.C.E., ETC., BOROUGH ENGINEER, ST. PANCRAS.

It is scarcely to be supposed that this subject dealt with from the practice and experience of London will be of the same interest to the Conference as would attach to main roads between inter-urban areas, for the latter are usually macadam roads under traffic of quite different character, having therefore a different destructive effect, and they can be formed without the limitations frequently applying to roads in towns, where, instead of adopting the most suitable form or camber for the character of the pavement to be laid, it is necessary to work to certain levels, determined by existing thresholds or vaults, to alter which would involve prohibitive costs. Other conditions applying to town roads, such as the existence of tramways, the intersection of branch streets, and perhaps electric lamp columns in the centre of a road, all affect the form of a road, and have considerable influence on the distribution of traffic, and consequently on the wear of the pavement.

The greater amount of traffic, its convergence into more definite lines, and its greater destructive effect due to its character and weight, necessitate the adoption of a carefully constructed pavement of granite setts, wood blocks, or asphalt in all the main lines of thoroughfare in the larger towns, and it is in regard to these that the substance of this paper will more especially apply, though some reference may be made to other materials.

It needs no argument to secure acceptance of the first essential condition that in the construction of any road a substantial foundation is required. For all paved roads this is invariably formed of Portland cement concrete varying in thickness from 6 in. to 1 ft., depending on the nature of the substratum, and whether or not this has been largely trenched for sewers or pipes for various purposes.

* The complete list of papers is given in Appendix B.

In all cases the concrete should be regarded as permanent, laid to last for all time, or as nearly that as the interference by other bodies having statutory rights to cut it up may allow. While the surface pavement must be renewed from time to time the concrete should not require more than repairs to the surface.

Probably nine out of ten borough engineers would give their preference to granite setts as the most suitable material for any road subject to heavy traffic, having regard to the more important general conditions applying, such as durability, which may be taken to cover not only ultimate life, but freedom from frequent repair and facility for repair—and, dependent upon these qualities, its economy. It is quite true that certain granites which would give best results on these points only are open to objections on other grounds, such as insecure foothold or excessive noise, but there are available granites of such a character that, while escaping these last objections, still give good results as to durability and cost. The question of cost is entirely dependent on locality and facilities for delivery at low freight costs.

Local considerations frequently justify the adoption of wood paving on account of the much less noise produced by passing traffic. It may be either hard wood or soft wood. The former usually means Western Australian jarrah and the latter Baltic deal, almost invariably creosoted. 5-in. jarrah blocks and 6-in. granite setts are about the same in first cost laid, 5-in. creosoted deal blocks will cost about two-thirds the above, but prices vary with locality. The ultimate economy of granite is undoubted, but as between the two woods at present prices their relative life is about proportionate to their cost—that is, where their life is dependent upon their wear under traffic, and not cases where there is practically no traffic—and they last till they decay.

Asphalt is an alternative to wood where a silent paving is required; true one hears, more of the horses on asphalt than on wood, but less of the rumble of the vehicle. Asphalt is more easily cleansed than wood, but it gives a less secure foothold, and causes greater liability to skidding. Some localities give a general preference to asphalt and others to wood. There is practically no difference in first cost.

With regard to the shape of the cross-section of a road. There have recently appeared in the Press letters suggesting an alteration from the usual practice of the past, and instead of having the sides sloping outwards it is recommended that they should slope towards the centre, to make "a proper concave road, instead of the old-fashioned convex road." It may be agreed that the latter is "old-fashioned," but who is it says the former is "proper"? The only advantage suggested by the alteration is that the drainage of the surface would be towards the centre instead of towards passers-by, and consequently they would be less liable to splashing. Whether a road be convex or concave, the general cross-fall must be about the same to secure the removal of surface water, and with either it is not an even slope or straight bone that must be provided, but there should be a camber or slight rounding to allow for the wear of traffic without immediately having such hollows formed as would hold water. With the convex road the centre two-thirds is the best part of the road, as it has less cross-fall. It is most naturally preferred by vehicles, as being more free from obstructions, and it gives a driver more

latitude. But if a road be made concave these advantages are removed, for the sections of greatest cross-fall would be on each side of the centre line, there would be a greater number of puddles, and in swerving slightly from a course exactly in the centre the vehicle would be first canted to one side, then to the other. In country roads where the drainage is to side ditches the convex form of road is obviously more convenient than a centre channel with gullies.

There is a general desire to keep the slower traffic to the sides of the road to give the faster traffic less interruption in the centre. It is surely better to collect the drainage at the sides under the slower traffic than in the centre under the faster traffic.

The question of cleansing a road should also be considered, for in a busy town it is a work involving considerable risk to life, and if the men and carts have to do their work in the middle of the road instead of at the sides their risks are increased, and at the same time traffic is obstructed by the dust carts or vans. Someone may suggest this cleansing ought to be done before the traffic becomes busy ; so it is, but it has to be continued all day as well.

In normal conditions the cross-fall on a granite-paved road is fixed at 1 in 30 to 1 in 36, but this must vary between the maxima at gullies and the minima at the summits of channels between gullies.

With creosoted deal the cross-fall may be about the same as above, but with hard wood it should be a little flatter, say 1 in 40.

With asphalt the slope must be still flatter, 1 in 45, or 1 in 50.

In all cases the falls of the channels must be sufficient to carry off the water, say, 1 in. in 10 ft. for granite, or 1 in. in 15 ft. for asphalt as the flattest. The position and distance apart of gullies must be regulated by the side streets, the longitudinal fall, and the width of the street, but from 40 to 60 yards is about the usual practice.

On the subject of wear and tear. The life of any pavement depends on many factors, the amount of traffic, the composition of that traffic, the concentration in definite lines, the gradient of the road, and the nature of adjoining pavements. It needs no proof to say that the greater the traffic the greater the wear. But there is more importance in the composition of the traffic than may at first appear ; there is no class of town traffic so destructive to pavements as the horse omnibus, and the higher the proportion this forms of the total traffic so much the worse for the road. The regular stopping places of the omnibuses can be recognised by the state of the paving, more especially on wood paving. This is mostly due to the horses' feet, but partly also to the screwing of the wheels. It was found some years ago that at the West Strand Post Office, yellow deal blocks wore down $4\frac{1}{2}$ in. in 12 months ; this was replaced by jarrah, which wore $2\frac{1}{4}$ in. in three years ; but at this point there are from 300 to 400 omnibuses per hour stopping and starting. Heavy railway vans with two horses, usually travelling at trotting pace, are also very severe on roads. The existence of tramways or columns in the centre of a road lead to the traffic assuming a constant position in a road, with consequent additional wear in that track, while the centre may almost entirely escape. The gradient of a road increases the wear as it becomes steeper, and the downhill side is more quickly worn

than the uphill. This is on account of the faster pace increasing the wearing effect of the horses' feet, as well as the crushing action of the wheels. The influence of adjoining pavements is principally in regard to dirt carried from them by passing wheels—for instance, off macadam or flint roads on to wood; this dirt itself exerting a grinding action under traffic, but it also necessitates sanding or gravelling to remove the greasiness which results.

The following cases indicate the durability of different classes of pavement :

| Road. | Material. | Paved. | Removed. | No. of vehicles per hour. | | Width. |
|----------------------------------|--------------------|------------|--------------|---------------------------|---------------|--------------|
| | | | | Total. | Horse 'buses. | |
| Pancras-road ... | Mountsorrel setts | July, 1892 | Still good | 521 | — | 32 ft. |
| Fortess-road ... | Enderby setts | Jan., 1896 | Very good | 223 | — | 33 ft. |
| Euston-road (by Midland Hotel) | Jarrah blocks | June, 1893 | Oct., 1900 | 1,162 | 289 | 37 ft. |
| Euston-road (by Fitzroy-street). | Jarrah blocks | Mar., 1893 | Aug., 1906 | 765 | 128 | 30 ft. |
| Euston-road (by Fitzroy-street). | Yellow deal blocks | Mar., 1893 | Mar., 1899 | 765 | 128 | 30 ft. |
| Gray's-inn-road... | Jarrah blocks | Dec., 1897 | Still in use | 731 | 60 | About 35 ft. |
| Park-street | Jarrah blocks | June, 1893 | Mar., 1907 | 239 | — | 27 ft. |
| Upper Woburn-place | Jarrah blocks | July, 1899 | Still in use | 461 | 39 | 26 ft. 9 in. |
| Gordon-square (west side) | Jarrah blocks | June, 1893 | Still in use | Mostly cab traffic. | | — |

Similar particulars cannot be supplied for asphalt or creosoted wood paving, for both have only been laid about two years in the district dealt with.

Ordinary water-bound macadam is still used in streets of second-rate importance as regards traffic, and it is admittedly open to many objections; it rapidly wears into hollows, causing lodgement of water, too quickly for these to be individually repaired, and the recoating is necessarily frequent and expensive, but where all roadwork, including paving renewals, has to be met by the current rate and not by loan the general adoption of a more desirable pavement, and one less subject to complaint for one fault or another, is impossible.

Short sections of road have been dealt with experimentally by other systems. A length of road was recoated with Guernsey macadam, and after being rolled hard and blinded with dry chippings it was tar sprayed during September of last year. There is a fairly heavy traffic over it, and it has never become solid; it is always working, and the tar has produced a greasy black mud in wet weather, much more objectionable than the ordinary macadam mud.

Another road was stripped and coated with 4 in. of tarred slag macadam in November, 1907. It unfortunately happened that during the month the work was in hand it rained almost daily, and soaked the foundation of hard core on clay, with the result that the surface of the tar macadam worked loose under traffic in many places, and there has never been as regular and uniform a face as is desirable.

CONSTRUCTION AND MAINTENANCE.

In another road, where the foundation was known to be bad, was entirely removed, and a new hard-core foundation of broken York stone and other good material was rolled solid to a depth of about 18 in. On this tarred slag macadam 4 in. deep was spread in two coats and well rolled in, July, 1908. This also has broken up in patches. The traffic is not large in point of numbers, but the vehicles are mostly heavy—such as coal and railway vans.

In July, 1908, another road was stripped, and the foundation found to be perfectly solid. It was covered with tar macadam 4 in. thick, the same material being used as in the last case. This has proved to remain quite solid, and no fault has been observed since it was laid. The traffic in this case is about the lightest possible, for there are really only the tradesmen's carts calling at the various houses to use it.

It has been observed that a greasy condition of surface occurs on all these cases of tar macadam during damp weather, due to the fine grinding of quite a small quantity of mud under the wheel traffic, and this causes the horses to slip a good deal, especially when going downhill. To counteract this, coarse sharp sand is spread very lightly, and is effective until it also gets ground up, making more greasy mud. Washing is then resorted to, and that gives a very good result until passing traffic carries on dirt from adjoining roads, or produces mud from the road itself, and the cycle is repeated.

All these tar-macadam roads are much more slippery in time of frost than ordinary granite macadam, and constant attention for clearing off droppings and for sanding is required; but even then complaints are received, describing one side of a bridge as a dangerous gradient which was never regarded as having any inclination worth remark prior to the use of the tar macadam.

In dry weather the foothold is excellent, and the silence of traffic is most noticeable, the removal of droppings is easily effected, and the reduced amount of dust is much appreciated. In many situations tar macadam may prove a most suitable road surface, but it is still open to doubt as to whether it will carry heavy loads without disintegration.

PAPER 10: BY JOHN A. BRODIE, WH.SCH., M.INST.C.E., M.I.MECH.E.,
CITY ENGINEER OF LIVERPOOL.

Notes on the Tonnage-Life and Wear of Stones in Road Surfaces.

In a short paper it is clearly impossible to do more than deal with some phases of the construction and maintenance of road surfaces, and the writer has therefore decided to call attention to some remarkable differences in wear of the same stone when used in varying forms of road surface construction as shown by records of traffic tonnage passing over them, which may be of interest.

NECESSITY FOR STANDARD OF TRAFFIC AND WEAR.

It is now generally admitted by those who have studied the question that the most reliable measure of the durability of a road surface is its tonnage-life, or the total tonnage of traffic it will carry before requiring a renewal of the surface; any intelligent roadman can quite easily take a census of the traffic passing along a given road and divide it into classes from which the approximate tonnage may be readily arrived at, and it appears surprising that this

method

method has not been more generally adopted by road engineers in this country.

In Liverpool it has been customary to take occasional records of the numbers and classes of vehicles passing along the principal traffic streets, and to reduce these records to a standard of tons of traffic per yard width of carriageway per annum; and a great point would be gained for the more accurate comparisons of wear and costs of street and road surfaces if this standard—which has long been in use and found satisfactory—could be universally adopted in this country.

It is also important that, if possible, practical standards of wear should be arrived at for the materials which can now be obtained in almost uniform quality and condition from the best-known quarries and other sources of supply, and it appears likely that useful standard figures of wear based on actual results of tonnage-life over road surfaces could, with a little co-operation, soon be fixed for each such material in any one class of surface—say, for example, in the case of macadam, on the tonnage-life per yard of width for a given thickness of coating.

Where, owing to the conditions or amount of traffic, it is not necessary or convenient to completely coat a macadam road, useful comparisons could probably still be obtained by accumulating the cost per unit for maintenance until the cost of a complete coating had been reached, and adopting this period or tonnage as for a complete coating.

It is, of course, probable that such standards would require to be judiciously used, as it is hardly likely that the tonnage-life of a material on, say, a 60,000 tons per yard width per annum street would compare exactly with that of, say, a 5,000 tons per yard per annum road, as, no doubt, the methods of maintenance, weather, climatic and other conditions, would materially affect the results obtained.

The result of tests made in Liverpool has been to show that there is practically only one type of material economically possible for all classes of stone road surface in that district, and the splendid road materials coming from the Penmaenmawr and other quarries in Carnarvonshire have proved to be not only the best and most lasting, but at the same time happen also to be the cheapest stone available for streets within cartage distance from the dock quay.

The same stone is used in the form of setts, accurately dressed to sizes, along the line of docks, and also in the form of macadam for streets of comparatively little traffic, and some interesting lessons may be learnt from its behaviour and life under different conditions.

STONE PAVING.

Taking heavy-traffic streets first, experience shows that accurately dressed setts—6 in. deep by 6 in. to 8 in. long by 4 in. wide, laid on a sound concrete foundation at least 8 in. deep, with a small sand bed between the underside of the sett and the concrete, the joints being thoroughly racked with hard shingle and afterwards grouted with a permanent pitch mixture, which prevents any movement in the stones, and renders the whole surface perfectly impervious to weather—give a life equal to at least $7\frac{1}{2}$ million tons per yard width, and under these conditions this life has often been exceeded.

It is at present impossible to say whether an equal tonnage-life

can be obtained from the similar but shallower 4-in. class of construction in streets taking, say, 60,000 tons per yard of width, as this would mean a life exceeding 100 years ; but experience shows that the total average wear of the setts has been exceedingly small, and it is a fact that many such streets exist in Liverpool to-day, having a life of from 25 to 30 years without requiring any important repairs during that time due to wear of the material.

ORDINARY MACADAM.

When the same quality of stone is used in ordinary macadam laid 6 in. to 7 in. deep on a sound, hand-pitched foundation, experience shows that the tonnage-life of the surface before requiring to be recoated is enormously decreased, and instead of $7\frac{1}{2}$ millions, a figure about 100,000 tons only, or about 75 times less than the result for setts previously given, has been obtained on a street of moderate traffic—a somewhat startling difference.

Of course, the two figures may be said to be hardly comparable, but they are so for all practicable purposes, and the broad fact remains that the surface of the macadam has—on the average—worn or been pounded down from 1 in. to $1\frac{1}{2}$ in., whilst the surface of the sett has not been worn more than from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. on the average.

It would not be safe to assume that the traffic tonnage-life here given for macadam is the average life obtainable from this material in a macadam road, but it is a genuine average life of a series of complete coatings of $1\frac{1}{2}$ -in. material on a practically level macadam street laid to a depth of about 6 in. on an excellent hand-pitched foundation carrying a considerable volume of narrow rubber-tyred vehicles, motorcars, and general light traffic, in which it has been customary to keep the surface in good order by completely recoating the whole width of the street as soon as the surface becomes generally unfit for comfortable use by bicyclists.

PITCH MACADAM.

Another interesting result has also been brought more clearly to light by these records of traffic tonnage. A portion of a macadam road surface has been removed to a depth of $4\frac{1}{2}$ in. and replaced by an equal depth of ordinary macadam stone, laid in two layers spread in the ordinary way, and, after dry rolling, the interstices have been completely grouted or poured up with a permanent pitch and sand mixture, so that each stone is embedded in or surrounded by the mixture, the whole being again rolled whilst still hot with a 10-ton roller until consolidated and rendered thoroughly impervious.

The results up to date show that when properly dealt with on these lines the life of the surface can be extended from 100,000 traffic tons to at least 750,000 traffic tons per yard of width, or $7\frac{1}{2}$ times the average life of the ordinary macadam under the same traffic conditions, though still, it will be observed, only one-tenth of the tonnage-life of the sett pavement street first referred to.

This improved result, whilst also remarkable, might almost be expected when it is borne in mind that embedded in such an elastic mixture the irregularly shaped macadam stones are firmly held up to their work very much after the condition of stone setts, and not being allowed any appreciable movement, they are so prevented from wear by the rubbing and grinding action so harmful in ordinary macadam.

That this is the case is clearly shown by the section of a piece of this surface the traffic on which has already exceeded 560,000 tons per yard width, the stones in which have been washed clean by a spray of petrol. Whilst the edges of the stones near the surface are somewhat rounded, the edges of all stones below the surface are as sharp as when originally laid, and this could not possibly be the case where there is any considerable amount of movement amongst the stones due to traffic.

The writer came to the conclusion that to obtain the best result with small stones it would be necessary to present a surface of each individual stone sufficiently strong in itself to take the weight of individual wheels without crushing and at the same time held firmly, so that the abrading action common in macadam should, if possible, be avoided.

MACADAM CONCRETE BLOCKS.

His first step in this direction was the formation of concrete macadam blocks, in which the wearing surface consisted of selected macadam placed by hand on a true surface in a mould—wearing surface downwards—strong Portland concrete material being subsequently filled in and around the stone to a uniform total depth of about $4\frac{1}{2}$ in., and undoubtedly, when properly matured before laying, these blocks give excellent results as regards wear and quietness.

A sample block has been laid for five years in a street having a traffic tonnage of 25,000 tons per yard width per annum, and it will be seen that though it has already exceeded the ordinary tonnage-life of a macadam surface there is no apparent wear on the stones, and it appears likely that a very long life can also be obtained from ordinary macadam stone under these conditions. They make an admirable and washable street surface for use in poor neighbourhoods, where cleanliness and impermeability are of first importance.

SMALL-STONE SURFACE.

In another experimental piece he has adopted a cube of a size roughly $2\frac{1}{4}$ in. by $2\frac{1}{4}$ in. by $2\frac{1}{4}$ in., and finds that he can get such a material broken sufficiently accurately for paving by hand at a cost not much exceeding ordinary macadam.

It will be noticed that as this depth, together with about 1 in. of stone bedding, is only about one-half the depth of the 6-in. sett used on the dock road, the same weight of material will cover a surface about twice as great, whilst as its cost per ton is about one-third there is an ample margin to provide for the extra cost of labour in paving the smaller pieces.

This surface has been paved on a depth of small broken stone of the same material, and the joints have been racked with small hard shingle, and both the joints and the layer of broken stone on which the surface stones have been embedded have been grouted and rendered impervious with the pitch mixture used in Liverpool.

The whole surface has been laid on a 6-in. concrete foundation, so that there may be no settlement; and as experience has already shown that there is no possibility of side movement even with sharp or triangular stones embedded in the pitch mixture, it would appear that the conditions of the full-sized sett paving have been arrived at as nearly as possible in the cheaper coating.

Assuming, as well may be the case, that such a paving should

have a life of 30 years under the average conditions of traffic on county roads, it would appear that a cheap and durable surface coating may in this way be obtained.

The sample piece on these lines has only lately been put down, and it is as yet too soon to express any opinion on its merits from actual experience.

PAPER 11: BY F. G. CARPENTER, WEST RIDING SURVEYOR.

Before attempting in any way to criticise the various methods of maintenance and construction which are now in vogue, it would be advantageous to shortly review the causes leading up to the existing difficulties and increased cost of upkeep.

Undoubtedly the principal cause of the increased expenditure and controversies of late years is the great alteration in the class of traffic passing over our highways, both as regards speed, weight, and method of propulsion. Only a few years ago the majority of vehicles using the roads were horse-drawn, whereas now a large percentage are self-propelled, comprising traction engines, heavy motorcars (each permitted to draw heavily-laden trailers), and the ordinary motorcar. Traction engines are used purely for hauling purposes, the damage done being caused by the great weight of the engine itself, by excessive vibration, and by the rigid and ribbed construction of the tyres. Many of the main roads in the West Riding are subject to constant traction-engine traffic, with the result that in wet weather they are badly damaged, whilst on the break up of a frost the injury done to the surface is very considerable. Traffic of this description is due to the ordinary requirements of business, and the cost of making good the damage done cannot be recovered; that for injury due to the transport of extraordinary loads, such as castings, amounting to 50 or 60 tons in weight, is recoverable, though in no case can the amount recovered be considered adequate, as in addition to the visible damage there must always be some the effect of which is not immediately apparent. Although the laden weight of a heavy motorcar is not so great as that of a traction engine, yet the damage caused to the road surface by vibration, weight, and rigidity of tyres is accentuated by the speed at which it travels. The use of these vehicles in the West Riding is increasing, and considerable expenditure has, therefore, to be incurred in strengthening many of the roadways, in some cases the road having to be completely rebuilt with a proper foundation.

With regard to the ordinary motorcar, it is now generally admitted to have a detrimental effect upon the surface of the roads, not perhaps immediately apparent, but none the less effective when a road is subject to constant traffic of this description.

The damage done in this case is caused by the suction of the pneumatic tyres when the car is travelling at a high rate of speed, and when one considers the enormous increase in the number of motorcars in use in this country—*i.e.*, 52,000 in 1904 to 125,000 in 1907—it must be admitted that the difficulties of road maintenance must correspondingly increase.

The effect of the altered conditions of traffic has been to emphasise the defects of the ordinary class of macadamised roadways, and to create a demand for a roadway which, in addition to being of sufficient strength, shall be impervious to moisture, and, therefore, practically mudless and dustless. The present and much

condemned method of binding together the aggregate of an ordinary macadam road by the use of road scrapings is productive of the greater part of the mud and dust found so objectionable, but for rural roads the cost of providing a better-class binder is prohibitive. Tar has so far proved to be the best material for binding, and its use has led to the production of many patented forms of tar macadam. To substitute tar macadam on all our roads would entail enormous expenditure, and it can, therefore, only be expected that the various highway authorities will undertake the treatment of those lengths of main roads that pass through towns or villages.

Foundations.—Where the foundation of a road is weak it naturally follows that the surface will be both difficult and costly to maintain, and under existing circumstances it becomes necessary to entirely rebuild the road, often at considerable cost. In such a case it would, perhaps, be advisable to obtain borrowing powers from the Local Government Board, who will, I understand, grant such loan for a period of about 15 years.

The foundation should be formed of rock pitching, hand laid, and composed of the hardest material obtainable. In the West Riding furnace slag, limestone, and hard grit stone are used, either of which will make a fairly good bottom.

Ordinary Macadam Surface.—The size of the metal generally used on the main roads in the West Riding is $2\frac{1}{4}$ in., that for patching purposes being 1 in. or $1\frac{1}{2}$ in. It is my opinion, however, that the time has arrived when the metal for roads subject to constant locomotive traffic should be increased in size from $2\frac{1}{4}$ in. to $2\frac{1}{2}$ in. or 3 in., for though this increased size may tend to the formation of a rougher surface, it would increase the resistance to crushing, and would also strengthen those roads where the foundation is faulty. The $2\frac{1}{4}$ -in. metal makes an excellent roadway, but difficulty is experienced in obtaining it well and cubically broken, with the result that by the time the surface is consolidated a considerable proportion is badly crushed, rendering the road liable to more rapid destruction by traffic.

The outcry against the use of road scrapings as a binder would, without doubt, be reduced if it were not that roadmen find it easier to produce a finished appearance with the aid of a liberal supply of scrapings than without, which practice, whenever detected, is quickly stopped. Chippings are used as a binder in some districts, but their general use would add considerably to the cost of maintenance.

Owing to the disintegration of the surface an ordinary macadam road requires constant attention, and it is incumbent upon all road authorities to include in their road equipment the scarifier, horse brush, and horse scraper. A considerable saving in manual labour is effected by the use of these machines, and the work of maintenance is consequently carried out with greater dispatch and at less cost. In addition, the judicious use of the two last-named machines will greatly reduce the discomfort caused by mud and dust.

Tarred Materials.—A surface made with a bituminous binder undoubtedly makes the best macadam roadway, and although the initial cost may be heavy, yet the ultimate cost will in all probability be found to be as cheap, if not cheaper, than the ordinary waterbind. By the use of a bituminous binder it is ensured that the road will form less dust and mud, and will also be practically impervious to wet, and, therefore, less liable to disintegration.

Experimental lengths of tarred granite, tarred limestone, and "Tarmac" have been laid down on some of the heavily trafficked roads in the Riding, and so far the latter material is giving the best results, but whether its ultimate life will warrant an extension of its use cannot yet be determined. The initial cost of "Tarmac" is high, but has certainly much in its favour. The first cost of the materials on the experimental lengths laid complete was as follows :

| | |
|------------------------|------------------------------------|
| "Tarmac" | 4s. 5d. per super yard. |
| Tarred granite | 2s. 2d. to 4s. 6d. per super yard. |
| Tarred limestone | 1s. 8d. to 3s. 6d. per super yard. |

The thickness of the coating of each of the materials was 4 in. consolidated, laid in two layers, the bottom being 3 in. thick of $2\frac{1}{4}$ -in. material, and the top layer of 1-in. to $1\frac{1}{2}$ -in. material. In comparison the cost of ordinary granite macadam in this county varies from 1s. 3d. to 1s. 9d. per super yard. Experimental lengths of "Tarvia" have also been laid in the West Riding, but sufficient time has not yet elapsed to enable satisfactory conclusions as to its suitability to be arrived at. The cost of the material laid complete works out at rather less than 2s. per super yard.

During the past two years several lengths of main road in the urban or built-up districts have been tar-sprayed or tar-washed, and, with few exceptions, this treatment has given great satisfaction. Most of the work was done by machine, and cost $\frac{7}{8}$ d. per super yard, which, added to the cost of sweeping and sanding, brought up the total to about $1\frac{1}{2}$ d. per super yard. This treatment undoubtedly prolongs the life of the metal by about 20 per cent., thereby repaying the cost of the dressing, in addition to the saving in discomfort to the inhabitants in the immediate locality.

Paved Roadways.—In all the more thickly populated districts, and particularly the industrial centres, macadam roadways are becoming increasingly difficult to maintain, and are, therefore, gradually giving way to some form of paved roadway. The principal kinds of grit setts used in this county are the Lancashire or the Yorkshire, which are of good quality, and cost about 7s. per yard super or 8s. if Hirst's steel strips are used. Granite setts, the various classes of which have to be imported, cost from 12s. to 14s. 6d. per super yard, with concrete.

The heavy expenditure incurred in paving a roadway is to a large extent recovered owing to the longer life of the material and the decreased cost of scavenging.

The time has surely arrived when the law regulating highway administration should be amended, for the interest in the main roads especially has become national. The vast number of highway authorities can certainly not be considered an advantage, tending as it must to many different methods of maintenance. In the West Riding there are 121 urban authorities, of which 89 have claimed to maintain under Section 11 (2) of the Local Government Act, 1888. Each of these authorities has a separate surveyor, and the same main road may pass through several districts.

The Railway Clauses Act, 1845, could, with advantage, be amended, for what road authority cannot testify to the great expenditure incurred in resisting the proposals of railway companies to cross the highways, and reduce the available width in some cases to one half, or to obstruct the free passage of traffic by the construction of level crossings. It is manifestly unfair that,

whilst road authorities are to-day spending thousands of pounds in the widening and improvement of roads, the law permits railway companies to encroach upon the rights of the public.

A matter which cannot be dealt with by the ordinary by-laws, and which should be included in future highway legislation, is the remedy of the nuisance and damage caused by clay and soil brought upon the roads by the wheels of waggons and carts used by farmers and others. This deposit upon the roads, particularly at certain seasons of the year, causes the metal to be picked up by heavy traffic, and, apart from the annoyance caused to the public, often results in considerable damage and additional expenditure.

The unsuitable nature of many of our roads to-day is not due to the absence of better forms of construction, but to the lack of money with which to carry out the required alterations, and until the money available is substantially increased little improvement can be expected. Additional revenue could easily be obtained by the increased taxation of locomotive and motor traffic, and with the assistance of a liberal grant from the Government much could be done to satisfy present requirements, especially if all main roads were absolutely vested in county authorities.

PAPER 12: BY ALBERT D. GREATOREX, M.INST.C.E., BOROUGH ENGINEER AND SURVEYOR, WEST BROMWICH.

The construction and maintenance of roads is a subject which has been very much in evidence of late, and since recent legislation has permitted our highways to be used in the present legal or illegal manner by traction engines, steam lorries, heavy and fast motors, they have been found quite unfitted for the traffic, which is daily increasing. A demand has, therefore, arisen for more durable and less dusty roads.

The author does not propose to enter into detail as to the method of construction of roads, so much having been written and spoken on this part of the subject of late, but rather to call attention to what he considers one of the main causes of excessive wear and tear, and which has not yet been dealt with by any papers on the subject.

WEAR.

The wear of the material on roads is due to two causes—the weather and the traffic—which react on each other, so that it is not easy to distinguish their effects

ACTION OF THE WEATHER.

The weather acts to some degree directly on the materials, but to a much greater extent indirectly, by increasing the wear from the traffic. Frost expands the moisture in the crust of the road, and in cases the material itself; and after thaw a general disintegration takes place, converting the surface into a stratum of loose materials into which the traffic cuts and the surface water soaks. Wet weather, by softening the muddy matter, which, under present practice, forms so large a proportion of road coatings, destroys the solidity and coherence of the road, rendering it less capable of supporting the traffic, and increasing the wear from crushing and rubbing together of the materials.

TRAFFIC.

The passage of vehicles over a road produces several effects, which it is important to distinguish. There is, first, the grinding

and crushing action of the wheels and horses' feet on the surface; secondly, the effect of the load in giving rise to bending and cross breaking strains throughout the whole thickness of the road coating. When the materials are loose and unconsolidated, either because they are freshly laid or from having been disintegrated, there is a third action—namely, a displacement of them by the wheels and horses' feet, accompanied by a rubbing together of the stones among themselves.

Another damage that has now to be met is the scrubbing off of the road surface owing to fast motor traffic. This allows the wet to pass through to the very foundations, and after a frost brings about the complete disintegration of the road. Something must be done to cope with this trouble, either by other means of constructing and repairing roads or finding some means for paying for the repairs.

Roads that hitherto had to stand but light traffic now have to bear fast motor traffic, which contributes but little to the rates.

It is not now so much a question of the roads wearing into ruts—that can be dealt with by having the ruts filled up from time to time—but the whole surface of the road is one series of holes and loosened material, due to the use of the roads by heavy motor-cars, which can only be remedied by coating the surface with material that will not be torn up by the scrubbing action of motor tyres and the disturbing action of heavy motorcar axle weights.

Almost the whole of this damage results through the roads being constructed of water-bound granite, which in itself must of necessity be to a large extent friable. It is next to impossible when a road is being constructed with the help of water to get every stone to dovetail in with its neighbours and remain in the position into which it was originally rolled. Various road binders other than water have been used in order to secure the material in its place.

Any material used as a binder for roadmaking, or for dust laying, should have the following qualities:

1. Form a perfect waterproof crust.
2. Be as effectual in wet weather as in fine.
3. In dry weather reduce dust to a minimum.
4. Must not be affected by sun, nor break up after frost.
5. Non-slipping for horses and other animals.
6. Prevent skidding of mechanically-propelled vehicles.
7. Afford even rolling contact with wheels of all types, and thus materially reduce tractive effort.
8. Be equally suitable for all classes of roads and all types of traffic.
9. Suitable for roadmaking or repairing in wet or fine weather.
10. Must not contain any substance deleterious to paint, rubber, or clothing.
11. Must not contain any chemical capable of poisoning fish or animals by admission to water-courses, nor be dangerous to tree-life.
12. Do without the addition of any sand or other dust-forming material to the surface.

That heavy wear and tear is being placed upon the roads by the misuse and illegal running of heavy motor vehicles no one can deny. The damage done by a 2-ton pneumatic-tyred pleasure vehicle is superficial compared with that done by a heavy motor-wagon with a total weight of 12 tons, which, although apparently

doing no surface damage, abrades the edges of the road metal forming the road, ultimately breaking up the whole surface and contour of the road.

The heavy wear and tear is caused :

1st. By the heavy weight per axle carried.

2nd. By the speed at which the heavy motorcar runs.

WEIGHT.

It is unnecessary to go into all the details of the Heavy Motorcar Order, but as regards the first cause—*i.e.*, axle weight—it is clearly defined by Articles V. and VII.

Article V. (1). Declares "that the axle weight of the axle of a heavy motorcar shall not exceed the registered axle weight."

Article V. (2). "That the registered axle weight of the axle of a heavy motorcar shall not exceed 8 tons, and the sum of the registered axle weights of all the axles of a heavy motorcar shall not exceed 12 tons" (irrespective of any wheel diameters or widths that may be used).

SPEED.

Secondly, as regards speed, Article VII. states that "the speed at which a heavy motorcar is driven on any highway shall not exceed 8 miles per hour, provided that :

(a) If the weight of the heavy motorcar, unladen, exceeds 3 tons ; or,

(b) If the registered axle weight of any axle exceeds 6 tons ; or,

(c) If the heavy motorcar draws a trailer.

Under any of these conditions, (a) (b) and (c), the speed shall not exceed 5 miles per hour, provided also that if the heavy motorcar has all the wheels fitted with pneumatic tyres, or with tyres made of a soft or elastic material, the speed at which the heavy motorcar may be driven on any highway shall not exceed :

(a) 12 miles per hour when the registered axle weight of any axle does not exceed 6 tons, and

(b) 8 miles per hour where the registered axle weight of any axle exceeds 6 tons.

Now 75 per cent. of heavy motorcars or tractors are run on steel tyres, and very rarely weigh light less than the 5-ton limit. Moreover, with a load of 5 tons, as ordinarily placed upon the platform, the hind axle weight fully loaded is above the legal limit of 8 tons.

Some manufacturers describe their steam wagons as being "6-ton steam wagons," and it would be interesting to test the hind axle weight of a 6-ton steam wagon.

In spite of the fact that Clause 3, Article XI., states that "the axle weight of the axle of a trailer shall not exceed 4 tons," you will see advertisements in the technical papers of a motor tractor drawing a load weighing 13 tons, and these advertisements are constantly repeated as evidence of the capabilities of these heavy motorcars.

The speed under the Act and these conditions shall not be more than 5 miles per hour, a speed which is habitually over-reached. This speed of 5 miles per hour, with or without trailer, does not mean 5 miles per hour average, for to obtain an average of 5 miles per hour it would be necessary to run at times up to 7 or even 8 miles per hour. With a speed limit of 5 miles per hour, the actual average, taking into consideration delays through traffic,

inclines, and stopping for water, is more likely $3\frac{1}{2}$ or 4 miles per hour.

In the opinion of the author, it is the combination of illegal speed together with illegal weights carried that at the present time is causing the serious wear and tear on our roads, and by without any further legislation the author is of opinion that, under Articles XII. and XIII. of the Heavy Motorcar Order, these illegal wagons may be prevented from causing this heavy wear and tear, and much good could be done towards reducing the excessive wear and tear on roads from this class of vehicles by the various road authorities over whose roads these wagons are run, taking the necessary steps to have the Heavy Motorcar Order carried out to the letter—*i.e.*, by checking speeds and weights of likely offenders.

Under these circumstances, it does seem unwise to continue to make expensive roads by the same methods, when it is known that they will be torn up again almost immediately. With the object of overcoming this difficulty, very many miles of roads in this country have been laid with a material known as "Tarmac." For main roads and roads subject to heavy and continuous traffic the author recommends a 4 in. consolidated thickness, and for roads subject to what might be termed ordinary vehicular traffic, such as residential streets, rural main roads, etc., a consolidated thickness of 3 in. is sufficient.

The material should be applied in two layers—bottom layer of $2\frac{1}{2}$ in. gauge material, consolidated in the case of a 4-in. road to $2\frac{1}{2}$ in., and in the case of a 3-in. road to 2 in.; a top layer of $1\frac{1}{2}$ in. gauge material, consolidated in the case of a 4-in. road to $1\frac{1}{2}$ in., and for a 3-in. road to 1 in. Each layer should be separately rolled, and the top layer, after rolling, well sprinkled with slag dust, and again rolled.

There should also be a cushion between the foundation and the road metal.

The weight of the roller recommended is from 6 to 8 tons. It should be borne in mind that Tarmac has very great natural consolidating properties, and is sent out ready for use. It should, therefore, be ordered in such daily quantities as can be dealt with from the trucks to the work. If allowed to remain in the trucks for long difficulty will be experienced in unloading, and if it is unloaded and stored it will not bind as easily as if used at once.

The ideal camber for a road will depend to a great extent on the class of material which is used for the road surface. Roads constructed of tar macadam require very little camber, a quarter of an inch to a foot from centre to sides being, in the opinion of the author, quite sufficient for the purpose. Too much camber on tar-macadam roads in certain weathers makes the road inclined to be slippery, and this should be avoided.

Whatever form of road construction is adopted, the following important points should be borne in mind:

The material should be such that it will economically yet efficiently bind all the component parts, prevent internal attrition, allow each stone to bear its due portion of the weight superimposed, have a waterproof crust, give even rolling contact with wheels of all types, be applicable to all gradients, must not present a slippery surface, remove the dust nuisance, and substantially lessen the cost of future maintenance.

Eminent road engineers have estimated the outlay necessary for putting the roads in an up-to-date condition at an enormous figure, and it is this increase of cost which has induced many to suggest that the expense should be born by the Imperial Exchequer, and by the heavier taxation of motors and other self-propelled vehicles.

In the opinion of the author, all taxation for motors and vehicles using highways should be devoted to the maintenance and improvement of main roads and not merged into other channels, and whilst users of heavy motorcars, and such-like vehicles, call upon local authorities to give them proper and more up-to-date roads, the local authorities should not have the roads destroyed because makers of such machines will not construct them in a proper form, but must in return call upon them to give all the construction possible so as not to destroy the road surface, or by means of the use of the Heavy Motorcar Order cause any illegal user to conform with its requirements.

PAPER 13: BY GEO. A. PHILLIPS, A.M.INST.C.E., COUNTY SURVEYOR OF GLAMORGAN.

About two-thirds of the total area of the county of Glamorgan is populous and urban in character owing to the mining and kindred industries. Portions of the remaining area are less thickly populated and more rural in character, with agriculture as the chief, though not the only, industry.

The traffic using the county main roads is very considerable in amount, and of a heavy rather than of a light character. Compared with the main roads in English counties, those in Glamorgan are mostly narrow, in some cases being not more than 15 ft. to 16 ft. between the fences. They are, however, similar to most of the roads in Great Britain in having little or no properly constructed foundations.

Previous to the passing of the Local Government Act of 1888 the main roads in Glamorgan were managed by a County Roads Board, acting under the South Wales Highways Acts.

From the date of the passing of the Local Government Act, 1888, and up to the year 1895, the main roads of the county were maintained under contract with the local authorities. Subsequent to that date they have been directly maintained by the County Council. For this purpose the county is divided into four districts, each with a main road inspector, acting under the direction of the county surveyor, in charge of the section men and the steam-roller gangs.

At present the length of main roads under the direct control of the County Council is 184 miles. Practically no roads have been "mained" since the advent of the County Council, the Council's policy being rather to contribute substantially towards the maintenance of district roads which are in the nature of main roads, conditionally upon the district authority carrying out, at its own cost, such improvements, as may be required, and subsequently maintaining the road to the County Council's satisfaction. The amount of contribution is a fixed annual sum based upon the already ascertained cost of upkeep and the amount of main road or through traffic using the road in question. The length of such subsidised roads in Glamorgan at present is 108 miles,

Steam rolling of the main roads was systematically commenced in this county in the year 1898-9, when a steam-roller was supplied to each district. Year by year the work of maintaining the roads became greater, until in the year 1902-3 each district was supplied with an additional steam-roller, all of which are employed throughout the year. Each roller has a crew of five men, inclusive of a foreman spreader who has charge of the men, and is responsible to the district inspector for the proper carrying out of the work. A weekly report is made on a printed form to the county surveyor, showing in detail the amount and nature of the work carried out by the roller gang. This report is signed by the foreman spreader and the steam-roller driver, and countersigned by the district inspector. The section men, whose lengths average $2\frac{1}{4}$ miles—the longest section being $4\frac{7}{8}$ miles—attend to the sweeping, scraping, cleansing of ditches, etc., the smaller repairs required in the intervals of steam rolling, and assist the steam-roller gang when carrying out work of recoating their lengths.

Up to the year 1895 the material generally used for surfacing the main roads was local stone obtained in the vicinity of the road, and mountain limestone, very little hard stone being used, but these have been found on most of the main roads to be too weak to bear the traffic, and year by year since the above-mentioned date the length of hard stone surface has been increased, until at present upwards of 100 miles of the more important main roads are coated with hard stone. This material, which consists of basalt, Cornish elvan, and North Wales granite, is imported, generally by water, and distributed by the railways to various points in the county. The gauge of stone used is $2\frac{1}{4}$ in. and $2\frac{1}{2}$ in., and is bound with chippings and gravel of the same stone as the metalling. No sand or road scrapings is used for blinding.

Since the advent of mechanically-propelled traffic the County Council have spent and are spending large sums of money in widening and straightening the main roads, as well as in widening and strengthening bridges and culverts, and generally improving the drainage. Where it is possible to widen the metalled surface without acquiring additional land a minimum width of 20 ft. of metalled surface has been adopted for rural areas, but this width is increased in the neighbourhood of towns to 24 ft. and over. This work has been and is being paid for out of the annual rate.

In the majority of cases, however, it is necessary to obtain additional land, and a minimum width of 30 ft. between the fences has been adopted wherever this is possible, which admits of a metalled surface 24 ft. in width and one footpath 6 ft. wide. Where buildings are subsequently erected along the road on the opposite side to that on which the footpath is constructed, the local authority usually keeps the building line back to admit of an additional 6-ft. footpath being constructed.

These improvements, entailing as they do in the cases of roads running along the sides of valleys the building of heavy retaining walls, are very costly, and the work is being paid for out of loan, the periods allowed for repayment being 20, 25, and 30 years, according to the nature of the works. In these improvements strong ballast foundations of local stone are laid in no case less than 6 in., and frequently as much as 9 in. and 12 in. in thickness. Where the improvements are simply widenings of existing

roads the ballast is usually broken to a gauge of $4\frac{1}{2}$ in. to 5 in., but where diversions to improve the direction or lifting of roads to improve gradients are carried out the ballast has been hand packed. A 3-in. coating of boiler ashes is spread on top of the ballast and then steam rolled before the metalling is put on. The metalling used is local limestone broken to a $2\frac{1}{2}$ in. to 3 in. gauge and bound with chippings and gravel of similar stone, the thickness of metalling being 6 in. In the ordinary course of maintenance these surfaces will be coated with hard stone.

Gradients no steeper than 1 in 30 have been adopted as far as possible on the main-road improvements, but in hilly districts this minimum cannot always be maintained except at prohibitive cost.

In diversions and improvements of sharp corners a minimum radius of 50 yards for the inner side of the curve has been aimed at, and in several diversions already carried out very much larger radii have been adopted, even up to 350 yards. Endeavours have also been made to get the landowners to agree to the fixing of open fences on curves in the place of hedges, but, as a rule, this has not been allowed.

With regard to camber, as the roads have been widened and coated with hard stone a flatter cross-fall than hitherto has been adopted. A section which is found very suitable for the roads in this county is one giving a maximum fall from the centre of the road to the channel or hazard of 5 in. in a 24-ft. roadway. About 2 in. of this fall takes place between a point about 9 ft. from the centre of the road and the side thereof, so that the fall between the centre of the road and a point 3 ft. from the channel is approximately 1 in 36. This gives a width of 18 ft. in a 24-ft. roadway in the form of a flat arch as the cross-section, with slightly steeper sides. In cases where roads are waterproofed this has been reduced so as to give a cross-fall in the centre portion of the road between 1 in 40 and 1 in 45, and flatter sides. Where roads have been constructed with more camber than above mentioned, and especially in narrow roads, the traffic has been entirely confined to the centre, with the consequence that ruts are quickly formed. On hills the cross-fall is slightly increased, according to the gradient of the hill, so as to divert the water to the sides as quickly as possible, and prevent streams running along the road and forming longitudinal channels. Around curves, especially sharp ones, the highest portion of the road is gradually moved from the centre nearer to the outer side of the curve and slightly elevated, so as to present as wide a surface as possible, with a cross-fall towards the inner side of the curve. This minimises the skidding of the wheels of all vehicles passing round the curve, and the consequent ravelling of the surface.

Traction and motor-lorry traffic in Glamorgan is constantly increasing, being used very largely in connection with the building trade, breweries, quarries, and in the delivery of goods which were formerly carried by the railways. The consequent wear and tear of the roads is very great. Light motor traffic is also very much on the increase. In the author's opinion, it is the heavy motor lorries and traction engines with metal-tired wheels that are responsible for the destruction of the roads to the greatest extent. Something should be done to increase the diameter and width of the wheels of heavy motors so as to

distribute the weight over a larger area of surface. Practically all the main roads in Glamorgan are macadamised roads, the only paving occurring in connection with tramways which are pitched with granite setts, and some of the surfaces over bridges which are paved with wood.

To cope with the dust nuisance, surfaces have been sprinkled with calcium chloride solution, and, although the nuisance has been somewhat minimised, the success has not been great. The author does not recommend the use of hygroscopic salts, for the reason that the keeping of the roads moist and soft tends to the more rapid wear of the surface. On each section of road that has been sprinkled in the manner indicated it has been noticed that the surface has worn into holes more rapidly than the adjoining surfaces which were not sprinkled.

Tar-spraying the surfaces has been carried out with success. The first section done on a main road in this county was carried out by hand with ordinary gas tar thoroughly boiled at a cost of slightly under 1d. per superficial yard for two-coat work, including sanding. Part of the length of road so treated was a hard stone surface and part a limestone surface. While in both cases the abatement of dust was attained, the trial was more generally successful on the granite surface, this being probably due to the better wearing quality of the stone. Subsequently another section was tar sprayed by machine, and, although this was carried out at a less cost—namely, about $\frac{1}{2}$ d. per superficial yard for two-coat work—its effect was not quite so lasting as that done by hand. In both cases, however, the trials were successful, and there is no doubt that the preserving effect which it had on the roads treated has more than justified the expense, as the treatment added at least 12 months' life to the roadway. Tarring of footpath surfaces has also been found very effective, resulting in a great saving in the cost of maintenance, while affording much cleaner and more pleasant surfaces to walk upon.

With the present experience the author is of opinion that tar spraying or painting the surface of a road well constructed with hard stone on a strong foundation promises the best and most economical results, both in the matter of dust abatement and suitability for modern traffic. Waterproofing the roads in this manner enables the camber of the road to be reduced to a minimum. Care should, however, be taken to properly construct the road with hard surface material on a sound foundation, and to tar the surface before it has been worn into holes or depressions, as it must not be expected that tarring of the surface will convert a bad road into a good one.

PAPER 14: BY J. S. PICKERING, M.INST.C.E., BOROUGH ENGINEER, CHELTENHAM.

The Systematic Patching of Macadamised Roads.

Whilst so much attention is at the present time being devoted to new methods of road surfacing in order to meet modern requirements, it is remarkable that little or no consideration is given to the simple but important operation of repair and maintenance by systematic patching. The practice now prevailing

both in towns and in county districts is to allow the roads to get into a general state of disrepair, and then to resurface them, or, where patching is attempted, the depressions are, as a rule, filled in with loose stone, which is left to be ground to dust or to be scattered by the fast-moving traffic, a system—or, rather, want of system—which cannot be too strongly condemned. However carefully a macadamised road is made, depressions will appear in the surface long before the road actually requires recoating, and if these defects are neglected the life of the road must necessarily be shortened. If a newly macadamised road is kept under observation during wet weather it will be seen that inequalities of the surface, which at first appear to be small and unimportant, gradually develop with the action of the traffic and the rain-water, until depressions occur which allow the water to be retained and the structure of the road to be weakened. Instead of allowing these depressions to remain and to become worse year after year, they should be systematically repaired as they appear.

When the roads are dry and hard the depressions should be neatly cut out and filled in with suitable patching metal, the smaller material removed being applied with any additional material necessary for binding purposes. After periods of rainfall the surface may not require to be loosened, and in this case the depressions should be filled with metal of a suitable gauge and covered with new binding material. Rolling and watering should then be proceeded with until the surface is uniform with the adjoining portion of the road. A patch applied in this manner may not require a shovelful of metal, but it necessitates the application of water and the use of a steam-roller. In practice it is found inconvenient and costly to use an ordinary steam-roller and a water-cart for patching purposes, the result being that the work is seldom systematically carried out.

The author has overcome these difficulties by the use of a specially-designed steam-roller and water-tank combined, a diagram of which accompanies this paper.

The length of the roller over all is 12 ft. and the width 5 ft. The rolling wheel, which is placed at the rear and on which the bulk of the load is concentrated, is 3 ft. 6 in. wide and 3 ft. 6 in. in diameter. A water-tank of 200 gallons capacity is placed over the rolling wheel, the water being distributed behind through a perforated pipe 3 ft. wide. The distributor is divided at the centre so that a spread of either 18 in. or 3 ft. may be given. The top of the water-tank is formed into an iron box in which cast-iron blocks are placed to enable the weight on the rolling wheel to be adjusted to the work it is required to do. The following are the weights of the machine under different conditions :

| | tons cwtls. qrs. | | |
|---|------------------|----|---|
| Weight on rolling wheel without added weights and with water-tank empty | 4 | 7 | 1 |
| Weight on rolling wheel with tank full of water but without added weights | 5 | 6 | 1 |
| Weight on rolling wheel with added weights and with water-tank empty | 5 | 18 | 3 |
| Weight on rolling wheel with tank full of water and added weights | 6 | 17 | 3 |
| Total weight of machine without added weights and with water-tank empty | 6 | 19 | 2 |
| Total weight of machine with added weights and tank full of water .. | 9 | 10 | 0 |

This roller has now been in daily use for the past nine months, and is found in every way satisfactory. It does its work quicker and better than an ordinary steam-roller, and its cost has already been more than saved in economy over the old system of carrying out repairs. The staff engaged in patching consists of the roller driver and two men. The metal used for patching is drawn by the roller in a dobbin cart, which holds about 2 tons. The roller travels at the rate of 6 miles an hour, and when rolling the speed is reduced to about 2 miles per hour. The water-tank is filled from the fire hydrants, or when working outside the water-main area the supply is taken from the nearest water-course, a steam water-lifter, with suction hose, being provided for this purpose.

The process of patching is a very simple operation, and as the same men are employed for the work they become so expert that it would be impossible a day or two after the patching is carried out to detect the position of the depressions in the road which had been made good. In order to show the sensitive and easy reversing action of the engine, it may be mentioned that the roller can be made to pass over a patch 18 in. long no less than 30 times in a minute. It is surprising to find what a small quantity of water is required when it is properly applied. The two taps governing the supply to the spreader at the rear are under the control of the attendant and not of the roller driver, so that the supply to the area being rolled can be regulated without waste.

When not required for road repairs the engine may be used as a tractor or for street-watering purposes, a tipping body to carry 4 tons and a water-tank to hold a thousand gallons being made interchangeable, as shown on the diagram. Springs are fitted on the main axle for use when hauling or street watering. A suitable chocking arrangement is provided to make the springs inoperative when rolling. This, however, has not been found necessary in practice, and the springs have a decided advantage in rendering the machine much less noisy in use than an ordinary roller.

The machine is most suitable for rolling tar-macadam roads, and it has been found specially serviceable in backing up street crossings and in maintaining at a proper level the narrow strip of carriageway which is always a source of trouble where it adjoins a tramway margin. It has also been used with success in finishing off a newly resurfaced road after the heavier rollers have partially consolidated the material, the advantage being that a true and compact surface is obtained without crushing the road metal. The roller could be made still more useful if it had attached to it a single-tined scarifier. The author believes that if suitable patching rollers were employed by county authorities there would be a considerable improvement in the condition of the roads throughout the country, and the cost of maintenance would be appreciably reduced. The number of rollers usually provided by county authorities does not permit of the patching work being carried out systematically, and even if the rollers could be spared for this purpose from their usual work of resurfacing, they would be found too cumbersome and unwieldy to properly perform the work, and the use of horse-drawn water-carts would be found too costly and impracticable. There can be no doubt about the economy of mending roads under the system advocated, to say nothing of the convenience to vehicular traffic. The author believes that the proverbial "stitch in time" is as true in its

application to the repair of roads as in any other connection, but, simple and elementary as the process of patching macadamised roads may appear, the fact that, although its importance is generally recognised, it is seldom carried out in a systematic and scientific manner is a sufficient reason for bringing the matter before the Conference.

It should, perhaps, be mentioned that the roller described is not protected in any way by patents.

PAPER 15: BY HENRY E. STILGOE, M.INST.C.E., BIRMINGHAM CITY ENGINEER AND SURVEYOR.

For convenience the author will divide the subject into paved roads and macadamised roads; and let him say at the outset the most important feature of both is the foundation. One may make the surface of the very best material procurable, but unless there is a good, sound, and well-drained foundation it is of no avail.

Of the paved roads we will take granite or other stone setts and pitchers, wood blocks, asphalt, and miscellaneous.

The first cost of any paved road is comparatively heavy; therefore, before deciding whether to convert a macadamised road into a paved road the necessity of the case must be considered. As a general principle, if a conversion is to be made, or if a new carriageway is to be constructed, in a neighbourhood where there is very heavy traffic, but important offices, shops, and dwelling-houses do not abut, a granite paving is employed; otherwise wood or asphalt, etc., is used. If a macadamised surface has to be renewed as frequently as once in two years, and to be patched intermittently, a stone paving will prove more economical.

If traffic weight is to determine the point, 250 tons per yard width per day of 16 hours may be taken as the limit for macadam. In laying down the two-year rule, the author has town roads particularly in view, where the cost of cleansing, watering, etc., has to be contended with to a greater degree.

At this stage it may be convenient to consider the life and cost of granite sett and wood paving and the loan method of paying for the first cost. The Local Government Board grant loans for the following periods:

| | |
|----------------------------|-----------|
| Granite setts | 20 years. |
| Hard wood | 10 years. |
| Soft wood | 7 years. |
| Concrete foundations | 20 years. |

Under average conditions of traffic in Birmingham, granite setts will wear for 30 years, hard wood 15 years, and creosoted deal 11 years (and in some cases longer). There is still a good value in the granite setts at the end of 30 years, and they can be taken up and re-dressed. The seven years' period for soft wood is too short, and if one calculates the interest and annual instalment for repayment, adds to them the cost of repairs—which becomes increasingly heavy as time goes on—it will be found that the financial operation is not a profitable one. The repairs may vary from 2½d. to 13d. per square yard per annum. Maintenance contracts extending over 20 years, at 7½d. to 8d. per square yard per annum, the paving to be left in good condition at the end of that time, are in force, and have lately been renewed in Birmingham with highly satisfactory results.

A table showing the first cost of granite and hard wood pavings, and the annual and total cost up to the end of their life, as compared with the cost of macadam in streets of heavy traffic, is given in the two following pages.

Before commencing any reconstruction of roads due notice should be given to gas, water, and other authorities having mains or services in the streets, so that they may have the opportunity of relaying, or examining the same. Otherwise the new work will probably be pulled up for the renewal, etc., of pipes soon after it is finished.

Stone Paving.—The foundation should consist of a bed of 6 in. to $7\frac{1}{2}$ in. of Portland cement concrete (6 to 1), the depth varying according to traffic weights and the depth of stone used.

All recently filled-in trenches should be dug out to a depth of 6 in. below the ordinary formation level, and for a width of about 6 in. to 9 in. on each side of the trench, and splayed back to an angle of 45 deg., then filled in with concrete.

If wet or clayey ground be present there should be a sub-bed, tightly rolled, of 4 in. to 6 in. of fine furnace ashes, to keep the clay down and the concrete dry. There is nothing better than fine ashes to stifle clay.

The paving stone most to be desired is a hard and tough material that will resist wear, and at the same time not become polished by the traffic. The author exhibits several samples of paving setts which have been taken up from streets in Birmingham. They speak for themselves; the Enderby granite has probably given the best results. A good size for pitchers is 4 in. wide, 6 in. deep, and 7 in. to $8\frac{1}{2}$ in. long, and for setts 4 in. cubes, or 4 in. by 4 in. by 5 in. deep, the stones to be carefully dressed and squared, with no greater discrepancy in depth than $\frac{1}{4}$ in. The author prefers the 4 in. by 4 in. by 5 in. setts, laid on a $\frac{1}{2}$ -in. sand bed in courses at an angle of 45 deg., with the channel courses, which generally consist of 12 in. by 6 in. flat stones or three courses of setts, laid longitudinally with the road, the setts grouted with Portland cement grout ($2\frac{1}{2}$ to 1). A pitch joint gives a slightly quieter paving, but the edges of the stones are more liable to be chipped off. Keep the traffic off the work until the concrete and jointing are set.

Wood Paving.—The same remarks as to the foundation apply as in the previous case. The most usual depth of concrete is $7\frac{1}{2}$ in., with $1\frac{1}{2}$ in. of Portland cement rendering ($2\frac{1}{2}$ to 1) finished with the steel trowel to a true and smooth surface, washed $\frac{1}{4}$ -in. granite chippings and sand being used, the rendering to be absolutely hard and dry before the blocks are laid.

Jarrah, karri, and blackbutt, also English oak in "prismatic" form and creosoted, are hard woods which have given good results. In these woods the most useful size of block is 3 in. by 4 in. by 9 in., and in creosoted deal 3 in. by 5 in. by 9 in. Jarrah, karri, and blackbutt should be laid with close joints and dipped one side and one end in a boiling mixture of pitch and creosote oil; there is no necessity to dip the "prismatic" oak blocks if creosoted, except the channel courses, the bituminous grout following down well between the joints. Creosoted deal blocks are generally laid with a slight joint, often kept open by laths 1 in. deep and one-tenth of an inch wide laid at the bottoms of

ROAD CONFERENCE.

THE FOLLOWING STATEMENT IS AN ESTIMATE OF THE COST OF CONSTRUCTING WOOD PAVED CARRIAGEWAY, AS COMPARED WITH THE SAME AREA IN WHERE A PAVEMENT IS LIKELY TO BE SUBSTITUTED FOR MACADAM, AND

| Material. | Period of Loan. | Cost per Square Yard. | Total Cost. | Repayment of Loan with Interest at 3½ per cent. Equal Annual Payments. | Annual Cost of Repairing, Cleansing, etc., per Square Yard. |
|--|---------------------------------|-----------------------|-------------|--|---|
| | Years. | s. d. | £ | £ s. d. | s. d. |
| Granite setts, 4 in. by 4 in. by 5 in., on concrete foundation. | 20 | 14 0 | 7,000 | 492 10 6 (= 11'82d. per square yard). | 0 6 |
| | | | | | 0 8 |
| | | | | | |
| Tarrah wood, 3 in. by 9 in. by 4 in. blocks, on concrete foundation. | Foundation, 20 | 5 0 | 2,500 | 175 18 1 (= 4'22d. per square yard). | |
| | Wood, 10 | 12 0 | 6,000 | 721 8 11 (= 17'31d. per square yard). | |
| | Wood, renew at end of 15 years. | 13 6 | 6,750 | 811 12 6 (= 19'47d. per square yard). | 1 0 |
| Prismatic oak, 3 in. by 9 in. by 4 in. blocks, on concrete foundation. | Foundation, 20 | 5 0 | 2,500 | 175 18 1 (= 4'22d. per square yard). | |
| | Wood, 10 | 9 6 | 4,750 | 571 2 11 (= 13'70d. per square yard). | |
| | Wood, renew at end of 15 years. | 11 0 | 5,500 | 661 6 6 (= 15'87d. per square yard). | 1 0 |
| Macadam | | | | | 2 0 |

CONSTRUCTION AND MAINTENANCE.

29

AND MAINTAINING AN AREA OF 10,000 SQUARE YARDS OF GRANITE AND MACADAM. IT IS INTENDED TO APPLY TO STREETS OF HEAVY TRAFFIC, WHERE THE UPKEEP OF MACADAM IS CONSEQUENTLY HEAVY.

| Total Expenditure during 20 Years. | Total Expenditure during 30 Years. | Remarks. |
|--|---|---|
| <p>£ s. d.</p> <p>Loan charges £9,850 10 0</p> <p>Repairing, cleansing, etc., for 20 years 5,000 0 0</p> <p>£14,850 10 0</p> <p>Repairing, cleansing, etc., for a further 10 years</p> | <p>£ s. d.</p> <p>14,850 10 0</p> <p>3,333 6 8</p> <p>£18,183 16 8 (=14'54d. per sq. yd. per annum).</p> | <p>Although the period of the loan is 20 years, the life of granite sett paving may be taken to be 30 years.</p> |
| <p>Loan charges :</p> <p>Foundation 3,518 1 8</p> <p>Wood 7,214 9 2</p> <p>Wood, renew (first 5 years) 4,058 2 6</p> <p>Repairing, cleansing, etc., for 20 years 10,000 0 0</p> <p>£24,790 13 4</p> <p>Loan charges : Wood, renew (remaining 5 years)</p> <p>Repairing, cleansing, etc., for a further 10 years</p> | <p>24,790 13 4</p> <p>4,058 2 6</p> <p>5,000 0 0</p> <p>£33,848 15 10 (=27'07d. per sq. yd. per annum).</p> | <p>The loan period is 10 years, but the life of the wood may be taken to be 15 years, and of the foundation 30 years.</p> |
| <p>Loan charges :</p> <p>Foundation 3,518 1 8</p> <p>Wood 5,711 8 4</p> <p>Wood, renew (first 5 years) 3,306 12 6</p> <p>Repairing, cleansing, etc., for 20 years) 10,000 0 0</p> <p>£22,536 2 6</p> <p>Loan charges : Wood, renew (remaining 5 years)</p> <p>Repairing, cleansing, etc., for a further 10 years</p> | <p>22,536 2 6</p> <p>3,306 12 6</p> <p>5,000 0 0</p> <p>£30,842 15 0 (=24'67d. per sq. yd. per annum).</p> | <p>The loan period is 10 years, but the life of the wood may be taken to be 15 years, and of the foundation 30 years.</p> |
| <p>... .. £20,000 0 0</p> | <p>£30,000 0 0 (=24'00d. per sq. yd. per annum).</p> | |

the courses. Adequate expansion joints are provided next to the kerbs, but there is very little expansion or contraction in the "prismatic" oak paving, and not so much in the creosoted deal as in the jarrah, karri, and blackbutt. Round gravel for surface dressing the paving should not be used; it is driven into the blocks by the traffic and destroys the fibre.

Asphalt Paving.—Asphalt gives a good wearing surface; it is clean, healthy, and durable; its great fault is slipperiness. The rock asphalt, laid in the form of powder on a concrete foundation, is compressed with heated irons into a homogeneous mass; when laid $2\frac{1}{4}$ in. thick (compressed) it will last 15 years under heavy metropolitan traffic. The cost is about 14s. per square yard, including foundation. The cost of repairs, averaged over the whole life, is 6d. per square yard per annum. The mastic asphalt, melted with a flux of pitch and about 20 per cent. of clean, coarse grit added to give a foothold, and laid in a mastic state, is not so durable as the compressed powder, and is sooner acted on by the sun.

"Durax" or "Kleinpflaster" Paving.—This paving is well worthy of attention, if properly laid. It consists of stone cubes (random) of about $3\frac{1}{2}$ in., laid in segmental courses, or oyster-shell pattern, the chord being about 5 ft. to 6 ft., on a foundation formed by trimming down the macadam crust of an old road. As in every other class of road, particular care must be taken to ensure the foundation on which the wearing surface is to be laid being strong and solid, otherwise there will be failure.

The author does not recommend laying the cubes on a sand bed or jointing them with sand, or even cement grout. He has laid $2\frac{3}{4}$ -in. granite cubes on a $1\frac{1}{2}$ -in. bed of bituminous binder, well rammed the cubes into it, and grouted up with a mixture of pitch and oil. The cost was 7s. 9d. per square yard, and the result very satisfactory.

Macadamised Roads.—In our country roads we are generally able to deal with the drainage of the formation and of the surface by means of the side ditches, but in towns if a wet formation level is met with it is sometimes necessary to provide a system of sub-drainage and lead the water away by means of pipe drains. The surface water (as from the paved roads also) is dealt with by gullies connected to the sewers, etc., the number of gullies depending on the gradients of the roads.

The carriageway should be of the same strength all over—that is to say, in excavating (or filling in) for the foundation, form it to the contour of the finished surface. When roads are kerbed and channelled the same should be laid on a bed of 6 in. of Portland cement concrete. A good foundation is a layer of clean clinker ashes or broken stone, 6 in. in depth when rolled solid; on this a second layer, consisting of hand-pitched slag or stone 8 in. in depth set on edge in the manner of a rough pavement. Over this layer a coating of broken slag or stone should be laid so as to fill up the interstices and form a smooth surface; each layer to be thoroughly consolidated by a 10-ton steam-roller. No round gravel should be used; it will work its way up through the metalling when thin, and it is not at rest in the road when under heavy traffic.

The metalling for finishing the carriageway should be of the best quality obtainable, tough and hard, broken so as to be as

cubical as possible, each stone to measure not less than $1\frac{1}{2}$ in. on the faces, and so that every stone shall pass through a 2-in. circular ring in any direction ; the same to be spread in two coats. The first coat having been uniformly spread over the whole carriageway, to be then rolled by a 10-ton steam roller until consolidated ; the second coat then to be uniformly applied and consolidated, and the whole surface receive a coating of fine chippings of the same stone as the metalling, the chippings to be screened through a $\frac{3}{4}$ -in. mesh, and to include the finer material down to dust. The carriageway to be well watered and rolled until thoroughly consolidated. On completion it should present a hard and perfect surface, true in level and cross-section, and be coated with a thin layer of $\frac{1}{2}$ -in. chippings of similar material, free from dust. The depth of the metalling will vary according to traffic, but 7 in. is recommended for first-class streets.

Instead of the water-binding method just described, the use of bituminous binders has recently been revived. The principle is to spread it about $\frac{3}{4}$ in. thick, lay the metal thereon, and squeeze the binder up between the stones by rolling. In heavy coating, the operation is performed in two applications. Good weather is necessary for the work, and it requires special care ; the cost is little less than that of tarred macadam. The results of the use of a bituminous binder are less wear and tear and less mud and dust, consequently a longer life.

The subject of tarred macadam is now receiving considerable attention. Its utility greatly depends on the ingredients, their treatment and mixing, concerning which space does not permit of writing. When it is said that this material will not stand heavy traffic, what is meant by it? It is not expected to wear like stone or wood paving. If the comparison is, with ordinary macadam, then the process of bituminous binding will not stand heavy traffic either. When tarred macadam is used, the author is in favour of a bottom course of 4 in. of tarred 2-in. stone and a top layer of $1\frac{1}{2}$ in. of fine, rather than finishing the surface with the larger stone ; he believes that this system is better for repairing purposes. A tandem roller is best for this work.

The traffic should be kept off all classes of macadamised roads while they are being constructed, and until the surface has dried out.

Taking into consideration the items of utility and cost and the facilities for construction and repair, the author is of opinion that of macadamised roads, one constructed with good stone (water-bound) on a proper foundation, and the surface properly coated with hot coal-gas tar, is the best. The system of tar-spraying roads by machinery has greatly facilitated and reduced in cost what the author considers one of the greatest boons conferred upon the users of macadamised roads. It lessens wear and tear, prevents damage by suction of pneumatic tyres, reduces dust to a minimum, reduces mud, and generally increases the life of the road.

Watering is unnecessary for maintenance on tarred surfaces, and when watering is resorted to on ordinary macadam the spray should be fine.

In repairing or patching ordinary macadamised roads, the surface of the defective place should be picked up, the old

material removed, fresh stone laid on and rolled in. The use of a little fine tarred stone will be found useful as a binder in dry weather.

In recoating, the old surface should be scarified not too deeply, the fine material and such of the old stone as is unusable removed, and the new stone be then applied.

Camber.—If the difference in level between the centre and side of a road were properly apportioned, instead of making the middle too flat, there would not be so much complaint of excessive camber. The author submits a diagram of ordinates, which he considers will allow of 1 in 25 for macadam, 1 in 36 for soft wood, and 1 in 45 for granite, hard wood, and asphalt paving.

PAPER 16: BY W. J. TAYLOR, M.INST.C.E., COUNTY SURVEYOR OF HAMPSHIRE.

Wear and Tear of Motor Traffic on Roads.

The introduction and expansion of high-speed self-propelled traffic, which we have witnessed during the past 13 years, has made it incumbent upon those who are responsible for the upkeep of roads to carefully watch and study its effect on them, as compared with the wear and tear of the older and slower moving forms of traffic, which now bid fair to vanish from our roads almost entirely. The almost unanimous verdict is that the wear and tear is very greatly increased by the faster moving traffic, and, at any rate, for a time, a check has been given to the renaissance of our main roads which was going on throughout the kingdom. The expansion of ordinary traffic, the growth in the number of traction engines (now some 8,000 or 9,000*), and, lastly and principally, this rising tide of automobilism, has had a marked effect on the annual cost of maintenance of our roads.

The following is a comparative statement of the annual outlay on maintenance and repair of the main roads in England and Wales during the past nine years :

| Year ending March 31. | Mileage. | Total Cost. £ | Rate per Mile. £ |
|--------------------------|--------------|------------------|---------------------|
| 1901 | 26,598 | 2,024,711 | 76.1 |
| 1904 | 27,223 | 2,366,163 | 86.9 |
| 1905 | 27,367 | 2,406,754 | 87.9 |
| 1906 | 27,380 | 2,478,481 | 90.7 |
| 1907 | 27,556 | 2,529,137 | 91.8 |
| 1908 | 27,600 | 2,644,718 | 95.4 |
| (partly estimated) | | | |
| 1909 | 27,600 | 2,766,903 | 100.2 |
| (estimated) | | | |

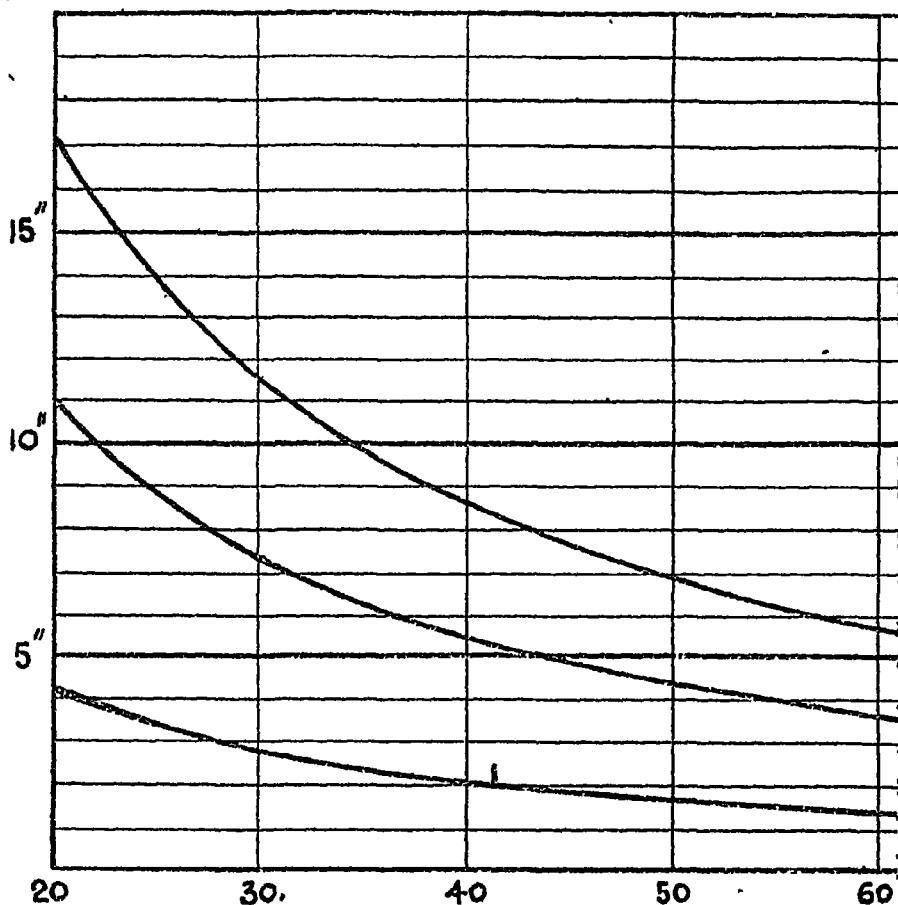
In this respect, however, we appear to be on the threshold of events only, as a very large proportion of our roads bear upon their surfaces eloquent records of the effects of high-speed traffic, and call for far greater outlays to fit them for modern forms of traffic.

Although the increase in cost has been general, the heaviest burden has probably fallen on the south-eastern half of England, in which portion about 56 per cent. of the whole of the motor-cars in the United Kingdom are registered, and, in addition to

* Mr. Howard Humphreys.

The Construction and Maintenance of Road

Super Elevation of outer Wheel Tread
in Inches



Height required in centre
of Road 26'-0" wide

| 12.99 | 33.27 | 51.99 |
|-------|-------|-------|
| 8.64 | 22.17 | 34.65 |
| 6.48 | 16.62 | 25.98 |
| 5.19 | 13.29 | 20.79 |
| 4.32 | 11.07 | 17.31 |

Note: It is not suggested that the above formulae
for Railway Curves applies absolutely to Motor
Cars on Carriageways

the great trunk arteries of traffic from the Metropolis radiating through it, we have to bear in mind that there are no local supplies of hard road stone which are capable of offering any effective resistance to the wear and tear of even ordinary traffic beyond that of a light character.

In dealing with this question of wear and tear of motor traffic, the writer offers no apology for considering its effects on poor roads repaired with local material, as this is the condition of affairs in a very large proportion of the mileage of even our main roads, and if there were no weak roads the deliberations of this Conference would possibly not be necessary.

The writer's experience of the effects of high-speed traffic on long mileages of rural main roads has been that it hastens the deterioration of the surfaces in some respects more rapidly than can be accounted for by a mere increase in the number of journeys made.

On well-made basalt surfaces where large gauge stone is used, the effect of unarmoured pneumatic tyres (except where the traffic is concentrated in one track) has probably not been so destructive as ordinary iron tyres, the area of contact in the former case being greater, but on roads repaired with flint and gravel the reverse has been the case, the finer particles have been drawn from the interstices of the stones, thus unkeying them, and the loosened material is crushed by all kinds of traffic, and there has been much loss.

It is, however, against the armoured tyres that our most serious charge is levelled, and complaint is widespread of the damage caused by studded and other forms of armoured tyre on all kinds of roads.

Injury is inflicted by the studded tyre in several different ways; in the turning movement the loosening effect of the studs is very noticeable; again, by reason of the small area of the iron studs through which the load is transmitted to the road surface, defects in contact appear to be intensified, and the rolling effort has a greater disturbing effect on the macadam. On account of the leaping or galloping motion acquired by cars running at a high speed, contact with the road surface is more or less intermittent, and the vehicle proceeds with a series of impacts, when the steel studs are not only destructive by reason of the shocks with which the small area of metal points is brought down on the road surface, but they corrugate it by kicking out the material. When the wheels, which are the medium of propulsion, leave the ground, they revolve at a greatly increased velocity, and when they again come down it is the road surface which has to do the work of reducing this revolving file to the speed of the car, with the result that portions are worn out of the road in its resistance to this tangential force; and many lengths of our roads repaired with all kinds of metal bear witness of this by the long lines of depressions and corrugations in their surfaces.

Another potent cause of damage to road surfaces is the wheel of small diameter which the makers of cars, especially those of the heavy type, have adopted. The well-known experiments of Morin early in the last century, and of those other investigators who have followed him, have, unfortunately, for some reason, not been followed. It is so well known how the rolling resistance is reduced as the diameter of the wheel is increased, and that passing

over unevennesses in the surface is accompanied by less shock with large than with small wheels, with consequent saving both to road and vehicle; that it is specially unfortunate that car designers have not been able to help the road problem in this direction, more especially when it is borne in mind that the limit of usefulness in merely broadening tyres is soon reached, as on a portion of its width only can a cylindrical tyre bear on a cambered surface, whereas by increasing the diameter the tread may safely be reduced in width. Roads under the writer's control have suffered very serious damage by the action of the small wheel. It sinks into the surface and imparts a wave motion to it by the forward or pushing effort, and the crust is disturbed, water admitted into the road, and the material loosened and lost by rubbing, attrition, and displacement.

These influences of the motor, making for the destruction of the road, are, however, greatly intensified and the cost of coping with them augmented when the traffic persists in holding to the centre of the road. It is the tendency of all vehicles to keep to the centre of the road, where the traffic is not sufficient to compel them to continually break track, and no doubt defects in the road have in places largely contributed to this centre tracking, but even where the sides are strengthened and the cross-fall reduced to a maximum of 1 in 24 it is most difficult to induce traffic to distribute the load, and so evenly and uniformly wear down and reduce the whole surface from margin to margin, thus enabling the engineer to avoid those costly and unsatisfactory patchings and repairs in detail. The combined effects of small and armoured wheels continually travelling in one track is to depress, groove, and often to cut through and destroy the surface of the road, no matter what material it may be made of; and it is a curious fact that it should be left to automobilism (to which good roads are so essential) to put upon the road surface the most destructive and, from the point of view of economical rolling contact, the most unscientific wheel that has ever been devised.

With the object of better fitting the main roads to carry the increasing traffic, most of the road authorities have for many years set themselves the task of abolishing the use of soft road materials, such as limestone, flint, and gravel, and using in their place hard stones, such as granite and basalt, and they have made and compared innumerable experiments to ascertain the stones most suitable to the varying local conditions of climate and subsoil. This work, which must be accelerated under new conditions, will, however, take a long time to accomplish, as the cost of laying down a 3 in. consolidated coat of granite on those 4,500 miles of main roads alone in the south-eastern half of England, which are yet repaired with local stone, will be about £5,000,000.

Good work is also being done in strengthening the road surfaces, which are now in many places mostly very thin and insufficiently supported on yielding foundation, or are without any foundation at all. This also is a work of great magnitude, and must necessarily occupy a considerable period. It is hopeless to think that substantial foundations can be built into our roads—except in special cases—as the initial outlay is so great and the improvement so local; the work will almost entirely be effected by dealing with the whole area of surface at once—that is, by gradually thickening the road crust, by laying down over the whole area of the roads a

little more material each time they are repaired than has been worn out, and so accumulate a more substantial road crust. But even this will cost many millions for each inch of added thickness to the road surface.

If, in addition, we can use bituminous coats and matrix, we may hope to resist undue wear and satisfactorily provide for—as far as that is possible—the demands of all forms of traffic, but it is very difficult to see how the funds necessary to accomplish this work are to be raised.

It will at any rate facilitate and hasten the coming of the perfect road if those responsible for the design and use of the motor will give the road engineer their active co-operation, and perhaps sacrifice just a little of the appearance, the speed, and the carrying capacity of the car to the interests of economical road repair and improvement. In Hampshire, where the expenditure on rural main roads has risen over 100 per cent. in nine years, the effect of single-track running, armoured tyres, and small wheels has been to divert from the task of road improvement generally, which was actively going on, considerable sums of money to make good avoidable damage, and a very serious check was administered to the progress being made with the roads, very largely due to the failure of automobilists to realise the unnecessary damage that was being inflicted.

PAPER 17: BY H. T. WAKELAM, M.INST.C.E., COUNTY ENGINEER AND SURVEYOR OF THE COUNTY OF MIDDLESEX.

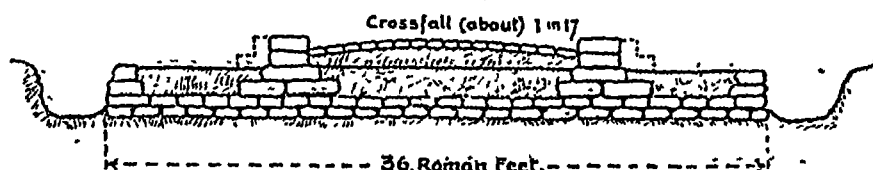
Road Construction, Curves, Gradients, and Camber.

In a paper so necessarily short as this must be it is impossible to describe fully the principles the writer advocates for road formation and construction generally. To assist discussion he has, therefore, prepared cartoons illustrating his views on the subject. It will be seen from the cartoons that the transverse gradients are differentiated to the adoption of various materials. The sections illustrated have been adopted by the writer in practice and found suitable to meet the various requirements of present-day traffic, and judging from the many requests he has received from prominent motorists and road users for an extension of the sectional curvatures shown, the cartoons are submitted with some degree of confidence as illustrative of designs suited in every way to both mechanical and ordinary vehicular traffic.

Section No. 1 shows the original construction of an old Roman road. It will be observed that the Romans adopted

SECTION N^o 1

ROMAN ROAD

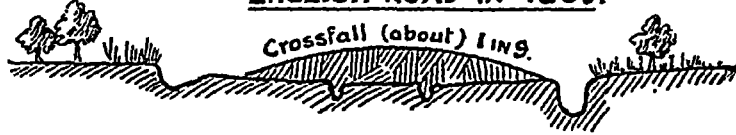


curvatures corresponding somewhat with those still in vogue, but the latter do not possess so much camber. The foundation is remarkable for its uniformity of construction.

Section No. 2 shows the construction of an early English road—the trenches for drainage and its extraordinary camber are its chief features.

SECTION No 2.

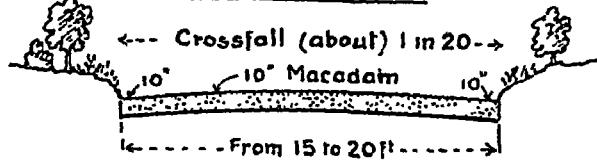
ENGLISH ROAD IN 1809.



Section No. 3 shows the section of an ordinary built-up road by Macadam. Until somewhat recent years Macadam's system was considered to be sufficient, and, in fact, to this day there are thousands of miles of roads in this country which possess no more

SECTION No 3.

MACADAM'S ROAD

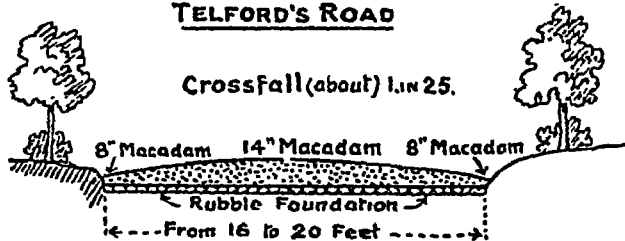


foundation, or greater carrying strength, than can be obtained from a road built up by layers of metalling applied from time to time.

Section No. 4 shows the construction adopted by the well-known engineer Telford. It is somewhat remarkable that on some lengths of the Holyhead road, which is considered Telford's greatest road work, that the foundation shown on the cartoon is not to be found. Whether it was that the expense of reconstruc-

SECTION No 4

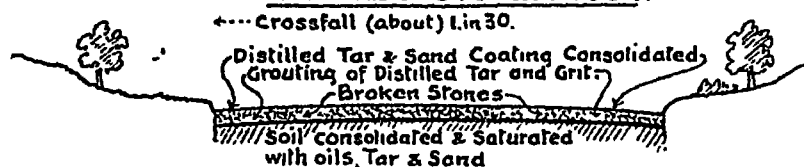
TELFORD'S ROAD



tion at that time on Telford's system was too great, or whether it was that the foundation could be dispensed with, are matters of conjecture. It can safely be said, however, that for present-day traffic a pitched or hand-packed foundation is positively requisite in connection with all main roads.

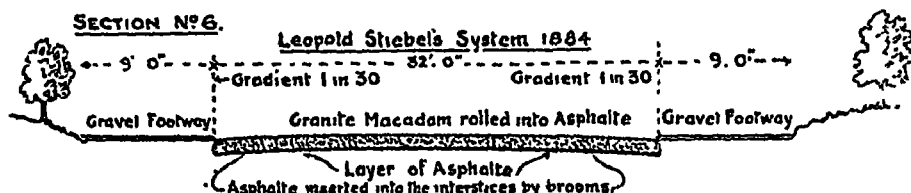
Section No. 5 shows the first system (Cassell's) traceable of an attempt to form a road with a matrix. It will be seen (1) that the carriageway was formed with the usual transverse curvature; (2) that the soil to receive the metalling was first saturated with

oils; (3) that the broken metalling was laid thereon and grouted with distilled tar and sand—the whole being consolidated afterwards, presumably, by hand or horse rollers. This principle of

SECTION N^o 5.**CASSELL'S SYSTEM 1834.**

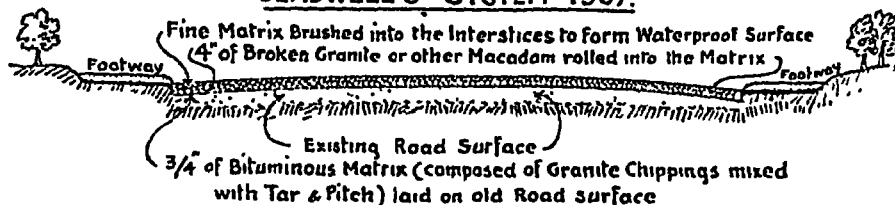
construction has practically been revived and is now being carried out extensively in some parts of England.

Section No. 6 shows "Stiebels" system of matrix construction, carried out practically in the same way as in Section

SECTION N^o 6.**Leopold Stiebels System 1884**

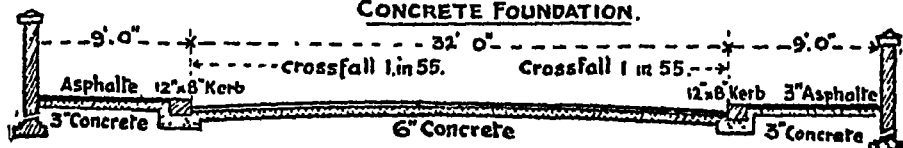
No. 5, with the exception that asphalt was used in place of distilled tar.

Section No. 7 shows "Gladwell's" matrix system, in which "Tarvia" (a compound of tar, etc.) is used with granite

SECTION N^o 7.**GLADWELL'S SYSTEM 1907.**

chippings. The materials are practically applied as in Sections Nos. 5 and 6.

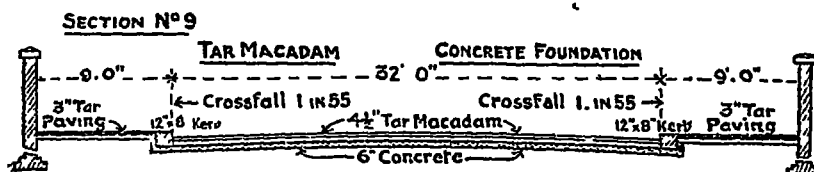
Section No. 8 shows the construction adopted in connection with Bradshaw's patented system—a combination of granite and asphalt with a concrete foundation. Large quantities of this

SECTION N^o 8.**BRADSHAW'S GRANITED LIMMER ASPHALTE
CONCRETE FOUNDATION.**

work are now being carried out. The concrete is laid in the usual way, the surface being formed with a mixture of Limmer asphalt and granite chippings of a small size. The materials are placed in large boilers and are thoroughly incorporated by

mechanical mixers, and spread whilst hot to the thickness of 2 in. The traffic can be quickly turned over the newly formed surface, and, judging from work the writer has had under observation for some time, granited-asphalt is likely to be of a lasting kind, even under heavy traffic.

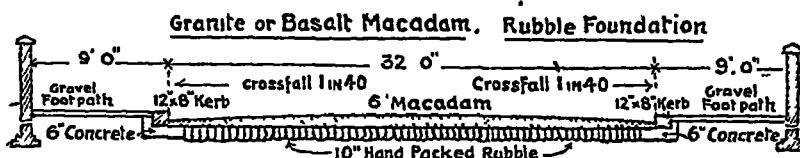
Section No. 9 shows a system of adopting tar macadam on a concrete bed. The latter may be replaced by an ordinary pitched or hand-packed foundation, but in the writer's opinion a tar-



macadam surface is better maintained, both in shape and otherwise, on a rigid, immovable bed, than when laid on an uneven foundation of rock, or other hard pitching.

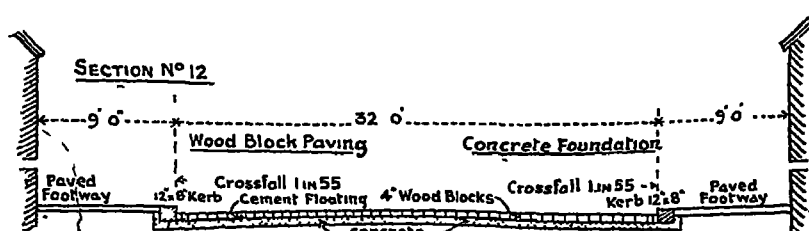
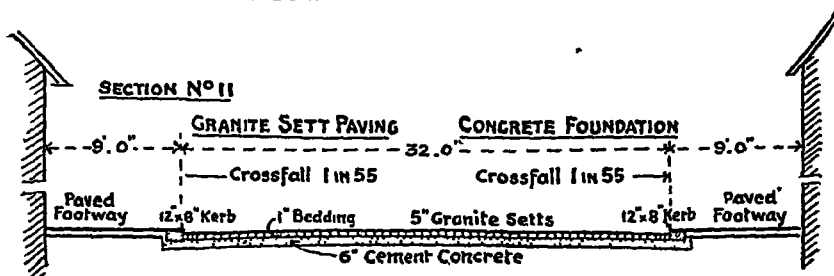
Section No. 10 shows a modern road with a broken basalt or

SECTION N° 10.



granite surface, 6 in. thick, laid on a pitched or hand-packed foundation 10 in. in thickness.

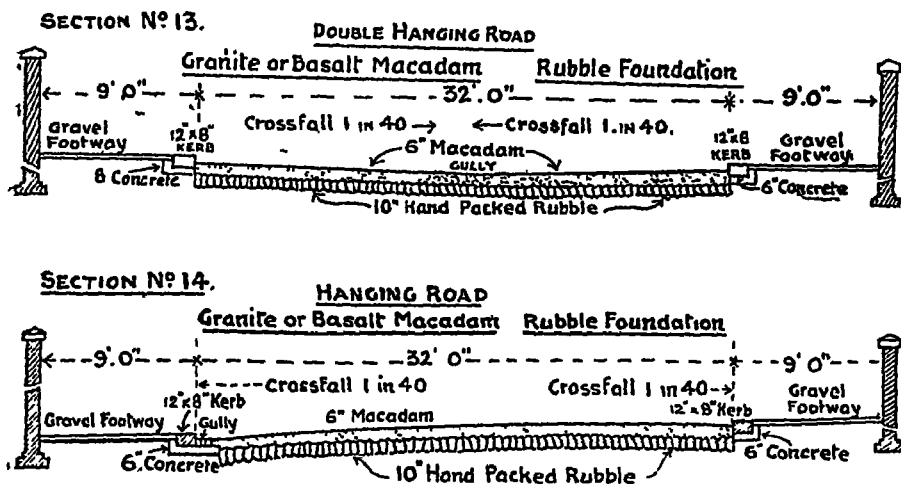
Section No. 11 shows a modern road paved with granite setts on a 6-in. concrete bed.



Section No. 12 shows a modern road paved with 4-in. wood blocks on a 6-in. concrete bed.

Section No. 13 shows a double hanging, or so-called convex, road; and

Section No. 14 shows a single hanging road.



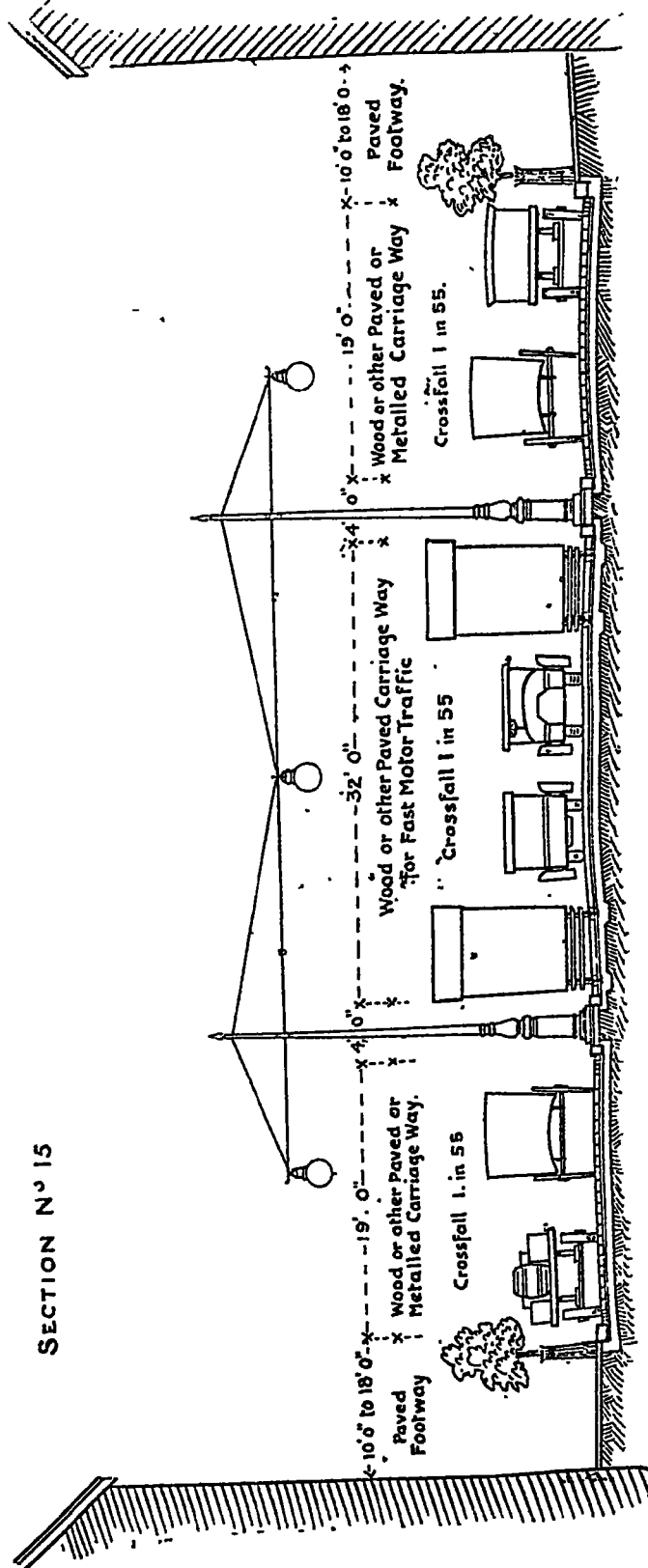
Roads to Sections Nos. 13 and 14 are strongly advocated in some directions, but they cannot be recommended by the writer for reasons which will, on a little reflection, present themselves to practical minds. Such sections could not be adopted for tramway construction, neither could scavenging operations be properly carried out without being a source of annoyance to road users and foot traffic across the roads. Intersections at cross-roads and diverging points would be difficult and unsatisfactory, and super-elevation at curves—so fast becoming an absolute necessity to prevent skidding of motors—would be impossible. The latter point is one to which more attention must be given to provide at sharp bends super-elevation (as on railway tracks) to a degree suitable for the fast motor traffic, to obviate the real danger which now exists in this connection.

Sections Nos. 15 and 16 show suggestions for new roads which might, perhaps, be advantageously adopted in connection with "town planning" schemes, or new thoroughfares along which (in the Home Counties especially) it would be well to make provision for dividing fast from slow traffic. Divisions of the kind would prove beneficial, inasmuch as the portions set apart for fast traffic could be constructed of materials different from those adopted to carry the ordinary traffic of the road, and by placing tramways on raised platforms, as shown on Section No. 16, the difficulty of constant repairs to the track margins after the permanent ways are laid (as at present at the road surface level) would be avoided. The raised portions could also be used for other purposes until the time arrived for their conversion into tramway tracks.

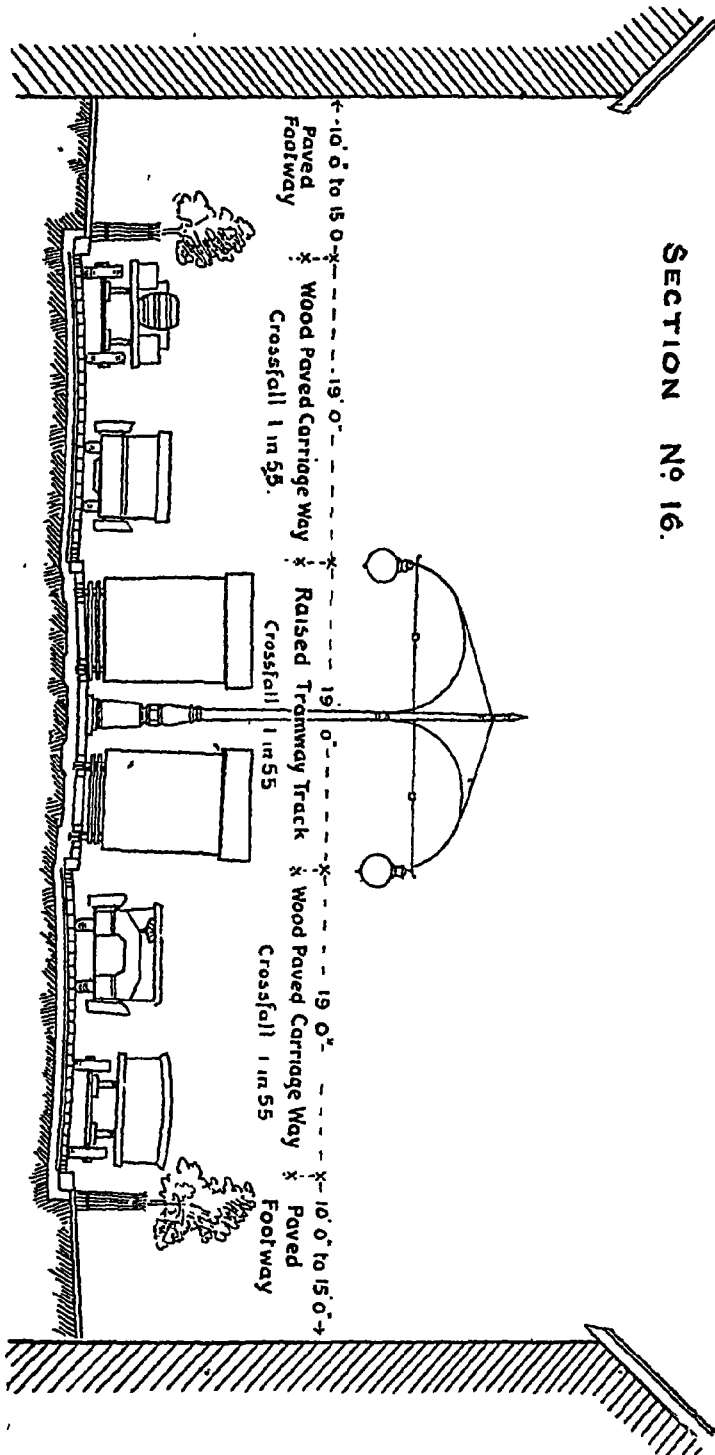
Section No. 17 shows a suggestion for a rural main road. Somewhat different principles of construction are requisite in this respect from the before-mentioned sections, and the writer has always endeavoured to standardise his reconstructions and repairs accordingly. It is, however, somewhat difficult to advocate its adoption as a general section in regard to transverse camber—so much depending upon the quality of the metalling used. For

ROAD CONFERENCE.

SECTION N° 15



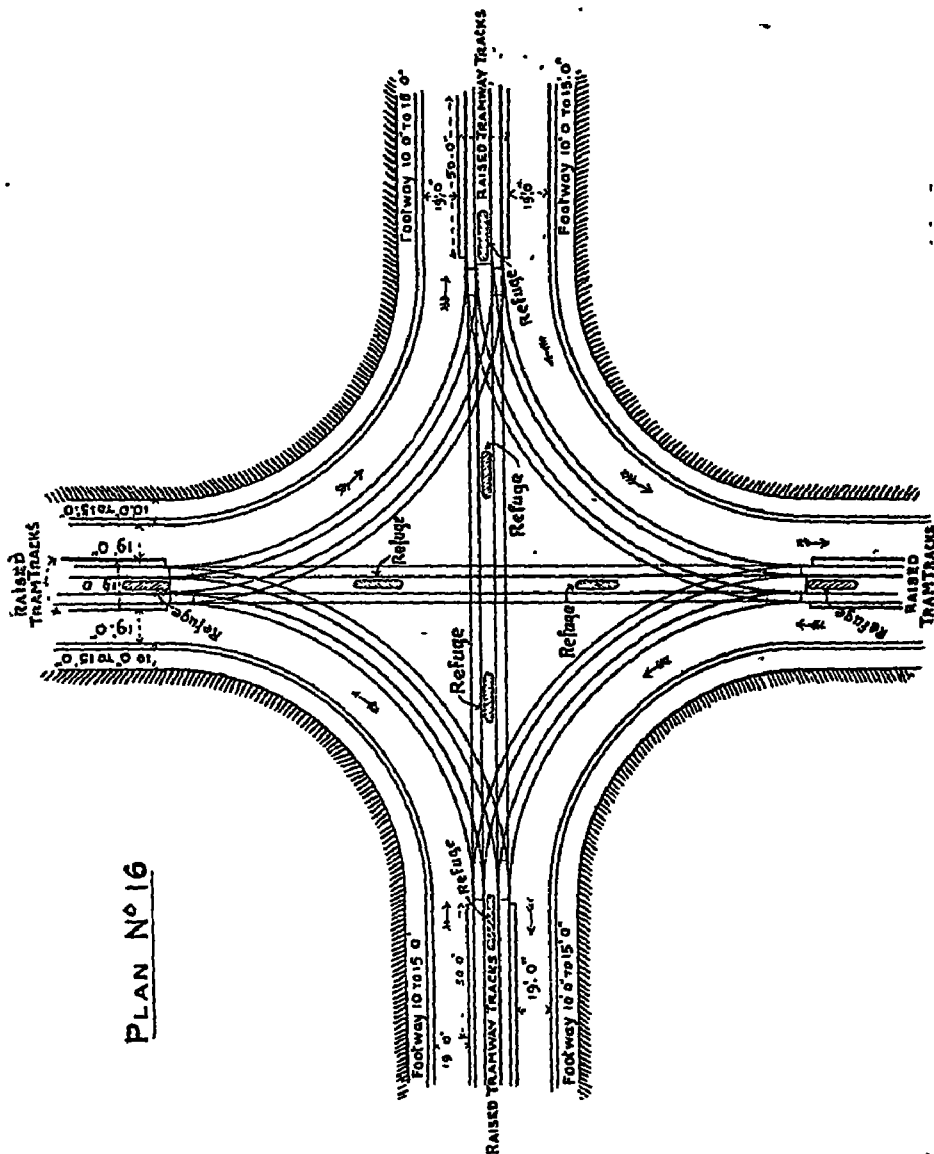
granites or basalts, or for other hard materials, the writer thinks a camber of 1 in 40 is the best to adopt. For the softer materials a cross-fall of from 1 in 30 to 1 in 25 is perhaps advisable, but for



motors, and other fast vehicles, such cambers are undesirable. Urban roads and streets are constantly swept and watered. This luxury is not obtainable on rural roads, and, therefore, a necessity

arises in connection with the latter for steeper transverse gradients than on town streets and roads, so that the surface drainage may be quicker, and facilitated, to counteract wear and tear where scavenging operations are not carried out as they are in urban and semi-urban districts.

The resolutions passed at the International Road Congress in October last dealt to some extent with the subject matter of this

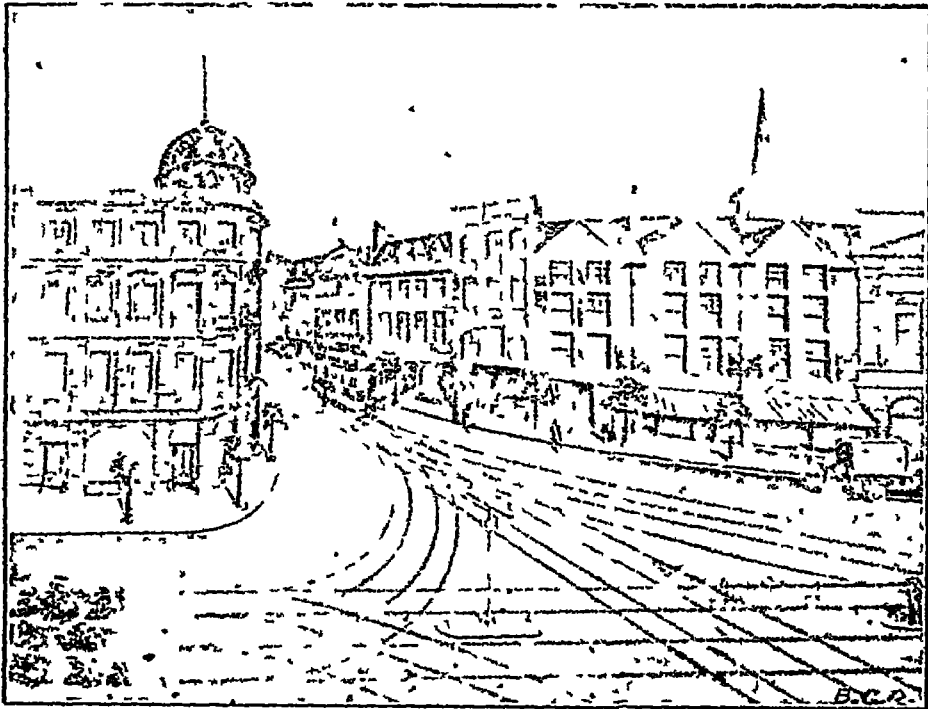


paper. The Congress drew attention to the necessity for the foundation of metalled roads to be constructed with the hardest and toughest materials procurable, whilst the foundations to carry paved surfaces should be constructed on concrete beds 4 in. thick. In choosing a system of foundation the nature of the subsoil, and the character of the traffic passing over the road, should be taken into account. In this country the writer has

never seen concrete foundations less than 6 in. in thickness, which should be the minimum thickness, to withstand any sudden impact of traffic on paved roads of any description.

For metalled roads the writer usually adopts (where the subsoil is good) a foundation course 12 in. thick if broken bricks are used, or 10 in. thick if broken rock is hand-packed throughout the transverse section. If on an ordinary clay bed a 4-in. course of clinker and if on plastic clay a 6 in. course of clinker in addition.

There is no doubt that the foundation of any road (like that of a building) is of primary importance, although in some countries to this day (as in Macadam's time) roads are built up by the use of metalling, without foundations, other than the subsoils upon which the metalling is placed. This principle is absolutely wrong, and accounts for the difficulties, troubles, and



No. 16 View.

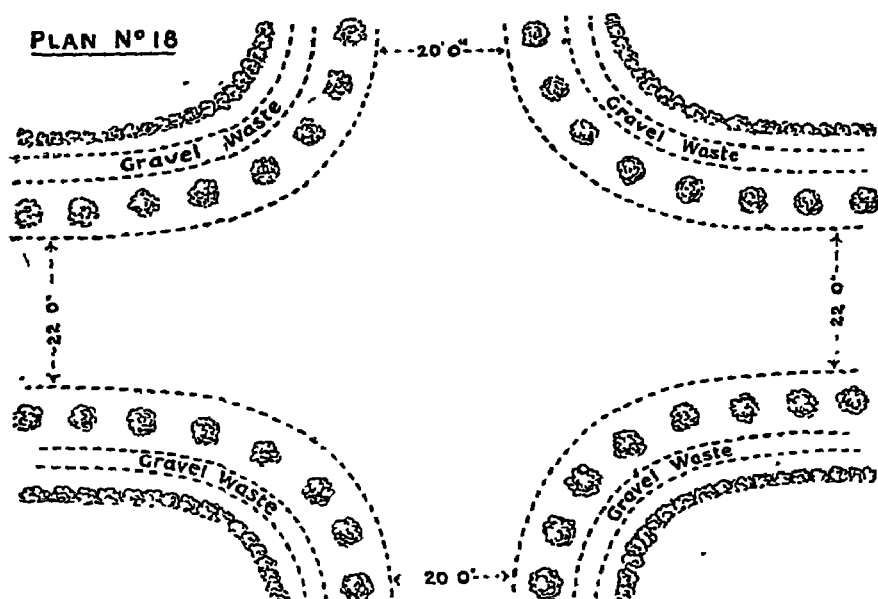
expensive maintenance now experienced in connection with the existing rural main roads of this country, thousands of miles of which are without proper and sufficient artificial foundations. Had such foundations been provided when the roads were first constructed, the latter would, no doubt, have firmly withstood the mechanical traffic and weights they now have to carry. Where such artificial foundations are not provided, the subsoils are, by the constant pressure of heavy traffic, depressed and knocked out of shape, surface sinkages appear, which are aggravated by motor and other wheel traffic, and wear and tear to a greater degree goes on than where roads have been formed with foundations sufficient to resist the resultant traffic pressure.

It is essential for the more important roads of this country to be classified as "trunk roads," and for those considered to be of importance for other local reasons or requirements, to be classified

as main roads, and that the two classes should, where possible, be reconstructed on some preconceived and settled lines as to :

1. Width of carriageway.
2. Foundations.
3. Under-drainage.
4. Transverse and longitudinal gradients.
5. Bed and surface finish ; and
6. Surface drainage.

It is most undesirable in the interests of the ratepayer to endeavour to build so-called waterproof superstructures, at an extraordinary expense, to withstand the present-day traffic without first of all providing the principal roads of the country with proper foundations, and to secure Imperial Exchequer grants for a general system of reconstruction of such roads, on proper lines, should be one of the aims of the Conference.



Whenever, and wherever, new roads are constructed it should be always remembered (1) that to meet present-day traffic a properly drained and practically impervious foundation is necessary ; (2) that the gradients both transversely and longitudinally should be within moderate limits ; (3) that the strength of the foundation and surface coating should be fully considered ; (4) that the hardest and toughest granites, or basalts, should always be employed for surfacing ; (5) that surface drainage should be amply provided for ; and (6) that at sharp bends, twists, or curves, super-elevation (as on a railway track) to a degree suitable for motor traffic should be provided, so that the danger now existing to motorists at places where super-elevation is not provided may be obviated. Super-elevation is quite an easy and simple matter to provide on a new road, and, as a matter of fact, it could be easily, and inexpensively, provided at a great number of what now are really dangerous bends and curves on the existing roads of the country.

In regard to camber, the cartoons show the transverse gradients the writer considers suitable for all purposes. At the Paris Congress it was laid down that it was advisable to have as little surface camber as possible, compatible with an easy running off of rain-water.

Eminent engineers at the Paris Congress differed somewhat in their views in regard to curvature, but, striking a mean of the figures stated by them, a cross-fall of 1 in 40 was the result for metalled roads.

In England 1 in 30 for metalled roads is considered by some engineers to be sufficient.

Roads constructed with either asphalt or tar macadam should, in this connection, be placed in the category of paved roads, in relation to which 1 in 55 appeared, from the consensus of opinion of engineers and road users in Paris, to be the most suitable cross-fall for adoption in relation to the present traffic.

Longitudinal gradients should never, if possible, exceed 1 in 25.

Cartoon No. 18 has been produced to show what the writer thinks is practically perfection in the way of trunk road curves, but on main roads of an urban character it is almost useless, under existing Acts of Parliament, to attempt to secure curves of such a character. A "Town Planning" Act would, however, doubtless open up ways and means for road authorities to lay down definite radii at corners and cross-roads, to the advantage and safety of road users.

A suggestion for a curve with a radius of 125 ft. will not, perhaps, be accepted by those opposed to motorcars and mechanical traffic, but as there does not appear to be any likelihood of a diminution of such traffic this radius is one worthy of adoption in connection with any new thoroughfares of importance which may be hereafter constructed.

The minimum curve of a tramway or light railway now accepted by the Board of Trade is 75 ft., and everyone is aware (who has had experience such as the writer has had in connection with the very extensive system of light railways and tramways designed and carried out by him as engineer to the County Council of Middlesex) that curves of so sharp a radius are not suited to present-day traffic.

In the kingdom of Portugal a radius of 100 ft. is the sharpest curve allowed.

In conclusion :

1. Curves should be connected with their tangents by parabolic arcs (as shown on Diagram No. 18).
2. Curves should be raised on the outsides to give a sufficient degree of super-elevation to make them safe for fast traffic ; and
3. Curves should be quite free from obstructions.

PAPER 18 : BY COLONEL R. E. CROMPTON, C.B., R.E., M.INST.C.E.,
M.INST.E.E., ETC.

On Reducing the Cost of Road Maintenance by Improved Construction of the Roads themselves, combined with Improved Construction of the Vehicles using them.

Although the title of the paper would permit it, the author does not propose to dwell at any length on improved methods of road construction further than to assume that certain developments,

are now well assured, and that in discussing future developments of the vehicle we may reasonably assume that the road of the future will also be constructed somewhat as follows: It will have a thickness of coating, or coating added to foundation, sufficient to distribute the stresses of ordinary highway traffic in such a manner as to prevent the general shape of the road surface being deformed by these stresses. It will be waterproof, and will have reduced camber, so that wide wheels can be used with a reasonable certainty that the load will be carried equally over the full width of the tyres. The binder used will be such as to hold the road material firmly in place, so as not to be disturbed under ordinary traffic. This last condition is, of course, incompatible with water-bound roads, as these latter can only during a few days of the year fully comply with it. It has been abundantly proved that such reasonably improved roads can be obtained at very slight increase in cost over and above the actual cost of maintenance of existing systems. The water-bound roads of to-day could not be maintained under the existing circumstances of increased traffic, however much the vehicles using them might be improved or however much speed were restrained, but now that, as has been confidently stated, upwards of 1,500 miles out of the 25,000 odd miles of main highways of England have been treated with a tar or bituminous binder, sufficient experience has been accumulated as to the increased duration of the road to make it practically certain that the future maintenance, when such binders are used, will be reduced so as to more than compensate for the increased initial cost of introducing such a binder.

The author's present suggestions as to the improvements that can and ought to be made in vehicles so as to minimise the wear of these modern improved roads may be summarised as follows:

1. The diminution of the vertical or crushing stresses on the road material due to the weight carried on the axles, and of the horizontal stresses applied to the road surface in the act of propelling the vehicles or trains of vehicles.

2. To improved methods of springing or of wheel construction in order to diminish the impact shocks of the wheel tyres, and thereby secure increased comfort for the passengers, durability for the vehicles themselves, including the important question of tyre wear, and at the same time reduce the wear of the road surfaces.

In considering these two matters, it is convenient to separate the vehicles using our roads into two classes—the heavy vehicles intended to carry goods at slow speeds, and the light vehicles carrying passengers and goods at higher speeds. In most cases the vehicles of the second class are, or ought to be, equipped with soft tyres.

The effect on the roads of the two classes of traffic as they now exist differs very widely. Taking the heavy class, I think everyone is agreed that much will be gained by increasing the bearing surface of the wheels on the road. Mallock has shown very clearly in his paper that the disturbances of foundations and the wear of the road surface itself depend chiefly on the maximum crushing strains. These, again, depend very much on the proportion of diameter to width, but if we take the common case of the maximum axle load carried on rigid steel tyres loaded to the limit allowed by the Local Government Board regulations, we find that a macadam road has to carry a maximum crushing

strain of about 820 lb. per square inch of the actual surfaces in contact, and that this strain pulverises or grinds to greater fineness the small particles already detached from the surface of the road, and in addition breaks away particles from the larger lumps of road metal. It appears likely that the only practical methods of reducing these crushing strains is by increased wheel diameters, and by reducing the axle weight by dividing the load carried or propelled over a greater number of axles.

The effect of increasing the wheel diameter is two-fold. On all roads having sensible camber it is difficult to considerably increase the width of the wheels, as the pressure becomes intensified on one or other edge of the tyre according as the vehicle is near the centre of the road or at points where the camber is extreme near the gutter, but by increases of diameter increased bearing surface can be obtained with reduced tyre width, and the crushing strains thus diminished; but the most important gain from increased diameter is that due to the reduced force of impact when the wheel meets any projection or loose stone lying on the surface of the road. In this case Mallock has shown that the force of impact due to the downward velocity of a tyre of radius r on a loose stone or prominence of height h will vary as—

$$\frac{4v^2 h^2}{r^3}.$$

In other words, that the damage to the road due to this impact will be reduced inversely as the square of the diameter of the wheels.

This saving in road wear and in vibration of the vehicles themselves, due to the lessened force of impact, has been long familiar to the author, but the introduction into modern vehicle design of wheels of increased diameter has been greatly retarded by two causes—first, the idea which prevails amongst designers that the weight of the wheels themselves is increased in some function in excess of the square of their diameters. While this was undoubtedly true when wheels were built up with wooden naves, spokes, and felloes, the only iron used in their construction being in the tyres, it is not true when the wheels are scientifically constructed of metal throughout. The author has shown in a paper read before the Institution of Automobile Engineers that with modern wheels made of iron or steel the weight of the wheels for equal rigidity, durability, and strength increases only as the diameter, and he hopes that the removal of this error may encourage designers to increase the wheel diameters in future road vehicles.

But there is a second cause why designers, especially of lorries intended to carry loads in towns, have provided driving wheels rarely exceeding 3 ft. 6 in. diameter. This is that in most cases it is a great convenience to load these vehicles over the sides, which can be lowered on to the wheels for this purpose. Of course, this necessity does not exist in vehicles making long journeys, which can be easily loaded at the ends, and it does not exist in the case of tractors which do not carry their own load but draw it behind them in trailer wagons. In both the latter cases the present standard diameter of driving wheels of about 3 ft. 6 in. might with great advantage be increased to 4 ft. 6 in. or 5 ft.,

according to circumstances, and for tractors traversing very soft roads to 6 ft.

Turning now to the second method of reducing the crushing and driving strains on the road by dividing the weight to be drawn or propelled over more than one driving axle, we are met with the difficulty that as we reduce the weight carried on these driving wheels we also reduce the adhesion which gives them their driving power. Under the best circumstances the horizontal or driving stresses put on the road in the act of propelling the train can never exceed half the vertical stresses put on them—in other words, the coefficient of adhesion never exceeds 50 per cent. of the insistent weight, and in most cases varies between 25 per cent. and 35 per cent. Hence a traction engine or motor wagon drawing trailers must have its driving axles loaded to a weight nearly four times the maximum draw-bar pull required to take the whole train up the greatest incline that will be met with on the road to be traversed.

This difficulty can only be surmounted by transmitting the driving strains to additional pairs of driving wheels—hence several road trains have been proposed, the most successful of which is the well-known Renard train, in which a comparatively light leading vehicle supplies the motive power, transmitting it to the remaining vehicles of the train, so that one pair of wheels in each vehicle become driving wheels and contribute to the propelling power of the train. In this way it is possible to diminish the axle weights, the road crushing strains, and the driving strains in proportion to the number of wheels so driven—that is to say, with a train of three vehicles these stresses would be reduced to one-third, with five vehicles to one-fifth, and so on.

Although such trains offer certain inconvenience when used in towns on account of occupying too great a length of roadway, yet their use in a modified form up to three vehicles certainly presents such great advantages in reducing road wear that it ought to be favoured. The transmission of the power to the extra wheels necessitates extra machinery complication and increased first cost, but the author believes that where the first cost and subsequent maintenance of the road forms part of the working cost of the whole system of transport, that the decrease on road maintenance many times compensates for the slight increase in the first cost and extra wear and tear of the multiple driving wheel road trains.

This being the case, these two improvements in design, which assuredly will reduce road wear, ought to receive encouragement from the road maintainer—that is to say that if road vehicles are to contribute directly or indirectly to the cost of road maintenance, that these two methods, increased wheel diameter and transmission of the driving strains to more than one pair of driving wheels, should be treated preferentially so as to compensate the constructors and owners for their extra first cost.

Turning now to the second group of improvements—namely, those relating to the reduction of impact shocks—much can be done by designers. The question of the springing of road vehicles running at high rate of speed remained until recently a mystery confined to a few coachbuilders, but, thanks to Mr. Lanchester and others, the science of springing and of the location of the vehicle so as to obtain the best results has received a great impulse.

It is easy to see that the use of soft tyres, whether in the form of solid rubber or of the pneumatic tyre, is, as far as we at present know, a necessity for all vehicles driven at speeds in excess of 15 miles an hour.

The diagram kindly lent me by Mr. Mallock* shows the extent of the maximum road stresses due to rigid wheel tyres, solid rubber, and pneumatic tyres. The diagram is a very striking one, showing how very small are the crushing strains due either to solid rubber or pneumatic tyres. The author foresees that this point will be criticised on the ground that he has not stated the whole case, and that although the crushing strains on the road are undoubtedly diminished, yet that other forces are introduced by the use of solid rubber or pneumatic tyres, which damage the roads as much or more than the rigid wheels of ordinary vehicles do by the much heavier crushing strains. It is necessary here, therefore, to point out that what is called the "sucking action" of pneumatic tyres has never been proved to exist. The action which undoubtedly does remove the small particles of the road, leaving the large particles to be crushed into finer particles by the rigid wheels of other vehicles, and which crushed material is either blown away by the wind or raised as dust by succeeding pneumatic-tyred vehicles, is due to an entirely different action, which is not suction. It is that which arises from the deformation of the tyre as it approaches a road surface, which makes it scour or scrub that surface with a comparatively light force, equivalent to brushing it, and which has only effect on a water-bound road when the latter is either muddy or perfectly dry. The feeble binding power of the water as the road approaches dryness is insufficient to resist this brushing action of the pneumatic tyre, but a very thin coating of bituminous or tar binding entirely prevents it.

Again, it is necessary to consider the worst case of the steel-studded pneumatic tyres. In this case the brushing action is much intensified, and is coupled with increased crushing stresses, and with water-bound roads the grooving and removing of material where cars accelerate on leaving villages, or at the commencement of inclines, used to be very marked on all water-bound roads, and in many cases removed the surface of the tar-bound roads when the tarring was superficial.

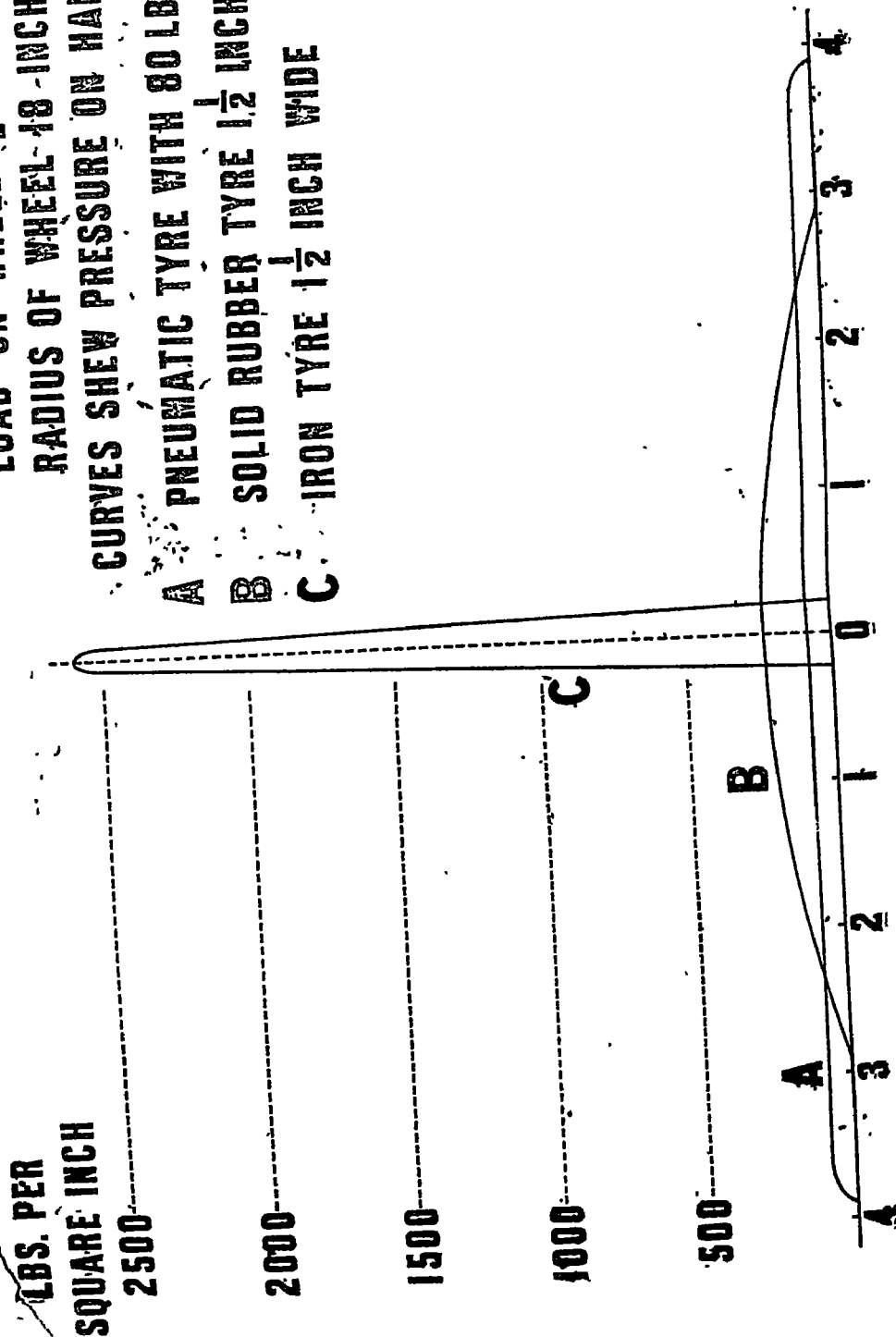
The author, however, has taken great pains to note the effect of steel-studded tyres on roads which have been tar bound to a sufficient depth. He has in mind certain portions of the Great North Road north of Hatfield, which two years ago showed grooves due to the action of the studded tyres, but which since they have been repaired and tar sprayed to a sufficient depth to ensure the tar penetrating $\frac{3}{4}$ in. from the surface, now at the same places show no signs of grooving. At the same time he deprecates the use of steel-studded tyres. Various forms of formed and hardened rubber faces are now available, which protect the drivers sufficiently against side-slip, even on greasy days in towns, and which have none of the grooving effects of those provided with steel studs.

Mr. Mallock's diagram shows that the crushing pressures and the forces of impact of pneumatic-tyred wheels are so low that little is gained by increasing their diameter. It is fortunate that this is the case, as increasing the diameter of rubber-tyred wheels is a very expensive luxury.

* See next page.

LOAD ON WHEEL $\frac{1}{2}$ TON
 RADIUS OF WHEEL 18 INCHES
 CURVES SHEW PRESSURE ON HARD SURFACE
 A PNEUMATIC TYRE WITH 80 LB. AIR PRESSURE
 B SOLID RUBBER TYRE $1\frac{1}{2}$ INCH WIDE
 C IRON TYRE $1\frac{1}{2}$ INCH WIDE

ROAD CONFERENCE.



The author was in charge of some experiments in India which lasted for eight or nine years, in which the rubber tyres of the driving wheels were upwards of 6 ft. in diameter, 18 in. wide, and $4\frac{1}{2}$ in. thick. In these cases the tyres of the wheels formed a very large share of the cost of the engine, but it is only fair, however, to say that their use reduced the wear and tear of the roads on which they ran to a notable extent.

PAPER 19: BY THE RIGHT HON. SIR J. H. A. MACDONALD, K.C.B.

Effect of the Horseshoe and Narrow-Wheel Tyre on Roads.

In the days gone by there were only two sets of persons to whom the road was a subject of interest—the roadmakers and the road users. The latter were a homogeneous body, all using the road in one way—viz., by animal power. The roadmaker utilised the animal power to do great part of the roadmaking for him, for it was not then held to be cruelty to animals, or to be an uneconomical mode of flattening a road after it was heavily metalled, to force the horse over the stones, and to use the vehicle behind him as a roller, the poor horse being driven over a loose and hoof-injuring foothold, while the load behind was practically doubled by the resistance of the loose stones to the traction. Cruelty to animals was universally practised, and the coach-building business was encouraged, by the overstraining of sinews and muscles and by the destruction of frames and wheels and springs. Thus the road was not really made until it had been used for traffic for months. When part of it had been rolled smooth the users had to go zigzagging about to evade the stony places left, and the roadman spent a fourth of his working day in shutting up the good parts of the road by obstructing half of the way with log horses during daylight, so as to force the citizen to do more road rolling on the other half. And so the weary round went on from year to year. And as it was the normal state of things, no one took active steps to cure the evil. The poor dumb horses could not complain, and the talking animal grumbled, but saw no way of relief.

Thus the road was made, and then began its destruction. Consisting as it did of stones and dirt, it had no lasting character. Nobody expected anything else than that it should be carpetted with water and mud in wet weather, and with dust and loose rounded stones in dry weather. In wet weather the roadman scraped inches of mud to the side, and in dry weather raked off loose stones which had left the surface, and having lost their sharp edges by being loosened in their seats and rubbed together by the traffic, would no longer take a firm seat in the bed.

It is quite certain that the formation of mud and of dust, which is just dried mud, must be the consequence of failure of the road as a firm, coherent, smooth surface, and of water penetrating it and not running off it freely. The purpose of this paper is to consider the cause which, in the days of animal traffic only, brought about this disintegration of the road surface. Naturally enough, the unthinking public, upon whom mud or dust is thrown by inconsiderately-driven power vehicles, look upon them as the cause of the mud and the dust. But it behoves all who are interested in

good roadmaking to look a little closer into the matter, and to trace the cause or causes with a view to remedy. Thick mud and thick dust are a cause of much economical loss to the community, whether they are thrown up or not. How great is the commercial loss caused by heavy roads?

Now no one will dispute that the operative cause by which a layer of mud or a carpet of dust was placed upon the road according to the weather was the vehicular traffic, acting on a road which was liable to have its parts moved by that traffic. In short, in the old days, the road being originally rough, the traffic gradually crushed it down more or less into smoothness, and in this slow process brought in the first action of injury, even before the road was in proper order for traffic; the stones being rolled first this way and then that way by the hoofs and wheels, lost much of their packing sharpness of shape, and got more or less rounded in their edges. In doing this, much small grit was rubbed from them, ready to be squeezed up to the surface in mud or dust as the stones moved in their seats. Thus the first step in ruin took place in the very making of the road.

Later, when the steam-roller came into use, this evil was to some extent mitigated, as there was not so protracted rubbing of the surfaces back and forward. But as there was less trituration producing packing material rubbed off the edges of the stones, binding stuff had to be added, and this was supplied by taking dirt, making a thick soup of it with water, and so introducing a wet cushion between the stones, and thoroughly soaking the stones themselves, which necessarily led to shrinking when drying up, and thus did not give an absolutely close packing. Thus the road could not throw off the rain so as to prevent it from penetrating the surface.

Such were our highways when the new and disturbing element of the power vehicle came to compete with animal traffic on the roads. Till then the road users were a united family. Since then there are two parties, between whom there has been much antagonism, but which must and will abate, seeing that it is now beyond all doubt that every year will see a great increase in the use of mechanical power on the roads, it being certain that its value, socially and commercially, will be recognised more and more.

The question of road construction has thus been brought into great prominence, and the road surveyors of the country have during the last five or six years laboured hard and successfully at the problem of road improvement. In the meantime it is a popular current belief not merely that motor traffic does affect the road as it exists, which is true, but that the power vehicle does the first part of the work of destruction, which is certainly not true. To test the question what it is that, given a good road, causes it to begin to show signs of breaking up, including loss of level, development of mud and dust, and penetration by water, which is the true cause of final failure, it is necessary to consider the matter in the light of ascertained facts.

The best test to be found of the effect of horse traffic is the case of a narrow road, such as a road along the side of farm fields, where the vehicles follow one another in the same track. "We find in such a case that in the centre of the road there is a space about 18 in. wide, in which all the true elements of a road disappear if the track has been left

unrepaired. In this space there is in dry weather a soft velvety carpet of mixed dirt and horse droppings. On either side of this there is first a ridge of unused road, and then outside these ridges two deep ruts, the surface at the bottom of each rut being, if the ground is not absolutely level, quite close and polished, unless where a boulder or brick is lying in it. At any low-lying part of this wheel track, the water which has run down from the hard surface lies and creates a constantly deepening hole. Now, this illustration of the farm road supplies the elements by which we may judge of the effect of horse traffic on a surface which is not firmly held together. The reason why the centre of the farm road is loose and velvety is because the toe action of the horse in hauling has gradually dug its way down until the loose cushion formed on the surface is sufficient to protect the ground below. The rut of the wheels is caused by the wheel gradually cutting its way down until the weight has so compressed the ground below that it is compact and immovable.

On a road where there is room and varied traffic, of course, no single line is made, but the effects as regards the foot disintegration and the wheel disintegration are the same, only combined. Every horse in pulling a load uses his toe as a gripping power to prevent slipping when he sets his weight forward to move the load, and this is, of course, done with more force when ascending a gradient. Now, as the stones in a road bound with mud cannot be tightly held, the horse's toe slightly moves a stone in its seat, a wheel going over that stone moves it again, and the wearing of the sharp surfaces has begun. Whenever by repeated movements the stone has got slightly rounded, the next picking action of the toe of the shoe tends to pull it out. Then comes the action of the wheel. The dimple left by the horse's toe is crushed down on both sides by the wheels, and if the stone is loose in its hole and the edge of the wheel comes on the side of it, the wheel turns it over and prises it out, or if the stone is out of the hole the crushing down widens the space left empty. Then comes the rain, and a small puddle is formed. Another toe deepens the hole, another wheel widens it, and so a large puddle is formed, from which water works its destructive way down to the bottoming, exposing the whole to the bursting effects of frost. While this process is going on the motorcar comes along, the pneumatic tyre sinks into the hole, and with a sucking action pulls out the loose mud or loose detritus, and so adds very seriously to the damage.

This is a true history of road destruction where the road is made in the ordinary manner, and the lesson it teaches is that it is bad economy to make a road of stones and wet dirt, however much you may roll it down. It contains the seeds of its own destruction from the first. Look at the bottom of a steep hill after heavy rain. The water has swept down the loose material, where it lies inches deep, and above the stones are bared. This calls for cure. Roads must be made to carry the traffic that the public desires to put upon them. It is vain to protest that it is the autocars that do damage, unless it can be said that the roads are as good as can be made at reasonable cost. Since the coming in of the railway, our roads have not been efficient for horse traffic. They have only been passable for the small amount of traffic which has run on them since the coaches and the carriers' carts and the long-distance wagons have been driven from them. There is now coming in a

revival of the road of which even yet few of the public have any conception, and the traffic will soon be as great as it was in olden days, if not greater. It will, I doubt not, be made plain at this Conference that highly efficient roads can be made without an overhead expense much exceeding or possibly exceeding at all the present cost. The initial cost being somewhat in excess of that of making a mud-bound road is the only difficulty. But practical people will easily overcome objection on this ground, when they are satisfied that the difficulty of making a sound and serviceable road for modern traffic is not insuperable at reasonable cost, particularly if the cost of upkeep is less, and so the original additional expense is recouped.

A very simple and decisive demonstration could be made to settle the question whether it is horse traffic that acts primarily and directly in disintegrating the highways. Let a short loop be made at a convenient place, where the road is frequented by horse and autocar traffic. Let both sides of the loop be laid down exactly in the same way, and direct each class of vehicle to use one side of the loop only. I can say from my own experience that the result is certain. Where I live in summer there are two avenues. On one there is practically no horse traffic, and the autocar tracks are smooth and free from holes. On the other there is daily horse traffic—railway and tradesmen's carts, etc. On that avenue holes are constantly forming, and have to be filled up. One can watch from day to day the formation of these holes by the picking and crushing action of the horseshoes and narrow metal tyres.

I apologise as an amateur for saying a word at a technical conference. But the experiences of a user are sometimes helpful to the manufacturers, and I will express the hope that this Conference will be fruitful in results for the benefit of the rapidly increasing community to whom good lasting roads are a necessity of life.

PAPER 20: BY THE RIGHT HON. LORD LEIGH, WARWICKSHIRE COUNTY COUNCIL.

The Treatment of the Grass Sides of Roads.

Owing, perhaps, partly to the fact that riding as a means of travelling from one place to another is no longer made use of, the grass sides of the roads, called technically, I believe, the pads, are often not treated in the way they should be. Far too frequently the road scrapings and cuttings, instead of being carted away, are heaped up on the grass sides and there left. Eventually grass grows up and covers them, and the heaps become permanent eyesores and obstructions.

Then, again, the drainage of the roads is carried to an excess. An altogether unnecessary number of gutters are cut in the sides of the roads. Often they are as near together as every 6 ft. or so, and that on both sides of the road, greatly spoiling the grass sides for riding purposes; and surely those who ride should be considered as much as are those who walk and those who drive. Drain gutters should be cut on one side of the road only, or if in any special cases it should be considered advisable to cut gutters on both sides, then covered-in drain pipes should be used, at all events on one side of the road. An objection has been made to

the use of drain pipes on account of the expense it entails, but if only that number of gutters were cut that are absolutely necessary, instead of their being cut in the present indiscriminate manner, the expense would be probably very little, if at all, greater than it is now.

Another most objectionable feature in the treatment of the grass sides is the abstracting from them of earth, for the mistaken object of scattering it over newly-made roads as a so-called binding, preparatory to watering and rolling. Abstracting earth in this manner is, I believe, absolutely illegal, and should most certainly be stopped. In the case of a newly-repaired road near Kenilworth, holes 3 ft. deep or more were cut in the grass sides of the road for the purpose of abstracting earth. Earth has really no binding property whatever; it does no good; it does harm only. The usual course pursued by road surveyors is to lay down earth, then water it, and then roll it. One of two things then happens—either the earth remains near the surface to help to form eventually the dust that is so much complained of, or else the earth and water sink down and work under the freshly laid down stones, and then, the heavier the roller employed the more does it cause the road to bulge up at the sides. Macadam never used earth as a binding, and his rule, be it remarked, was not to lay down any stone that would not pass through a 2-in. mesh. Now stones are often laid down two and three times that size.

PAPER 21: BY THE REV. CANON RAWNSLEY.

Highway Vandalism.

In *Punch* of March 17th, among some necessary corrections in Johnson's dictionary, occurred the following :

"Highway.—A track maintained at the public charges for the use of mechanically propelled vehicles. A track for the use of all (obsolete.)"

It is because one feels that there is a risk of forgetting that the highways are for all classes of people, and that only one class is being largely catered for, that one ventures to bring before this assembly some thoughts upon the need of conserving in the best interests of the general public the beauty of our highways.

No one can object to improvement in the surface of the roads. In the long run it will be found to be an economy for all. The wear and tear of horse-flesh and the wear and tear of harness, as well as the wear and tear of motor tyres, are sensibly diminished by a good surface, but there can be no doubt that there has been a tendency amongst some highway authorities, by pressure possibly put upon them by owners of motor-cars, to forget that the motor gentry are not the only people to be considered.

The consequence has been a determination, whenever possible, to take a bend off the road; and again, when a bridge of the old picturesque humpback type is said to need widening, or to have developed cracks in its masonry owing to motor traffic and the traction engine, the highway surveyors, not content with condemning the bridge, have at once proposed the building of a bridge with no line of beauty in it at all, as straight-backed as a railway viaduct.

The idea of suggesting that motors approaching a bridge of this type should slow up does not appear to have entered their

heads. What the motor people demand is a straight run through at undiminished speed. A time may come when roads of this straight-run-through type may be necessary, and motors will be rigidly confined to them, but those of us who know the weariness and dreariness of some of the Italian roads, especially the roads through the level plains, and those of us who know the comparative want of interest of some of our English roads that follow the lines of the roads of the Roman occupation, must feel that, except for the man in the motor, these highways have no joy and little poetry.

As regards the bridges we are, I think, without excuse for this rebuilding of them to motor pattern. Many of them, especially in the North Country that I know best, are bridges that in the fifteenth century simply carried the mule packs. Later the carrier's wagon came in, and the packman's bridge had a stitch added to it, and it became a bridge for vehicular use. Later the coach traffic insisted that the bridge should be widened yet more, but the old bridge kept its curve and span, and if to-day, under the exigencies of new traffic, more swift and heavier, some of these old bridges show signs of shaking, it is quite clear if the "grouting machine" is brought into operation under expert advice, a large number of these bridges can be made monolithic in strength at one-third of the cost of building a new one.

I spoke just now of the poetry of the road. No one who compares our English roadways with the Continental ones, or with the roads in America, knows how much of the real refreshment of soul and body is given to the nation by the beauty of our roadside trees and roadside wastes.

The people who can best appreciate these beauties are not the road-hogs of our time. They are the people who ride, drive, or walk, and it seems to me little less than a scandal that in our administration of the highways we should have given so much attention to the roadway surface as almost to forget that the roads exist not only for swift passage, but for enjoyment and for thought.

There can be no question that the protest raised lately in the Northern Press by the Earl of Carlisle against indiscriminate tree-logging by the county highway authority is a timely one. Those who are lovers of the countryside, and who realise that our highways and byways are not only meant for wheel traffic but for the wayfarer also, and those of us who remember that the public more and more are driven from footpaths by the owners of private property on to the main road, feel deeply that a grave responsibility rests upon the keepers of our roads to conserve not only the metal covering of them, but the beauty and the charm of their surroundings.

As matters are now, from time to time the orders go forth from the authority to all owners of adjacent property to the highways to lop their trees, with threats of proceedings if the peremptory orders of the county official are not carried out. And the ordinary owner, who objects, is not aware that these peremptory orders can only be carried out at the discretion of the justice, after due notice given, and after a proper hearing of the case.

Side by side with the peremptory order there generally comes a suggestion that, if the owner does not care to lop his trees himself, the highway authority will do it for him, and the result is often acquiescence in this latter arrangement. The task thus falls into

the hands of roadmen who neither by training or practice are skilled woodmen, and who simply obey the dictation of the surveyor, whose chief concern is the seeing that his road surfaces shall be exposed as much as possible to sun and wind.

I have seen these men at work, watched them, instead of sawing from underneath, sawing from above, so that the bough as it fell tore a large piece of the lower side away with it. I have noticed that, instead of trimming off these mutilated branch stems close to the trunk, they have been left to stand out, untidy snags, all down the side of the tree near the road.

No one in his senses can object to the cutting away of boughs that in any way interfere with passing traffic, and, at the corner of the highways that meet, it is reasonable that hedges should be lowered in order to enable people to see approaching vehicles, but everybody in his senses will realise that men who use the roads are beings that have eyes to see and hearts to feel, and that more and more the people are becoming educated to a sense of the love of the beautiful, which is ministered to by, and finds delight in roadside loveliness, and which is distressed and unhelpt by roadside ugliness. A tree properly treated may have its necessary boughs lopped and yet the balance of the tree may be preserved. To a lover of trees nothing can be so distressful as a tree whose balance has been destroyed.

It may be true that to keep roads in perfect order for motor traffic the fewer trees and the less hedge on either side the road the better. But I have heard that there is such a thing as too-much exposure to sun and wind for road surface. That it has been found, in fact, in France and in Italy that the shade of trees has had to be encouraged to prevent an over-dryness of the surface of the road. On the other hand, I have heard it argued that people who ride in motorcars sit low, and are, therefore, unable to see the country, and the hedges are to be cut down for their convenience. My answer to this is, that the motorist goes at such a pace that he neither cares nor sees, and that the ordinary carriage person, or horseman, or pedestrian has a right to be considered. Highways belong to them quite as much as they do to the motorist, and to take away from this section of the public the chief joy of the highway is as cruel as it is unjustifiable.

If all owners of wayside property would follow Lord Carlisle's example and go and examine the work of destruction done by the roadman tree-lopper, they would probably find, in nine cases out of ten, that there had been no discrimination used, that all the trees had been dealt with in the same manner, no matter of what kind they were, and that the scenic effect of this indiscriminate tree-cutting had been absolutely disregarded.

Lord Carlisle tells us that he found where the notice of the county surveyor had been obeyed "every roadside tree, whether single or in avenue, had been shaved perpendicularly on the side toward the road, or had been cut off if the trunk sloped in the direction of the road. It would have been better," he says, "had they been cut down at once. A gentleman shaved on one side of his head and face, and with one leg and arm removed, would appear symmetrical compared with these victims of administrative activity."

Our quarrel is not only with county authorities. The district highway custodians are quite as much to blame. One

passes up by-roads unfrequented by motor traffic, and seldom used except by a market cart; one finds just the same indiscriminate tree-logging, just the same carelessness of conserving the beauty of the roadside.

But the process of "uglifying" the countryside which is the most reprehensible, is the process of what is called cleaning up the roadside waste. Our highways and byways alike ten years ago were filled with delightful flowering plants. The wild rose and the honeysuckle ran riot, the broom and the gorse were golden, and the thorn bushes foamed with their snowy fragrance above the roadside waste; here and there in the hedgerows the rowans and the ash shoots and osier wands stood up in beauty against the distant blue, and foxgloves and campions were seen beneath.

None of these could be said to interfere with the sun and wind upon the road surfaces, for often between the hedgerows and the metal surface there lay a considerable stretch of turf. But the official word goes forth that the roadside wastes are to be cleaned up, and the roadmen, to whom all this roadside beauty of tangled undergrowth and glorious flower life and beauty of tree shoot is meaningless and mere rubbish, goes to work, and the road once so full of joy becomes a barren waste, the bird and flower lover is cheated of his gladness, and the peculiar beauty of the English wayside passes away without protest for a generation.

One cannot help thinking that this robbery of the British public's roadway pleasure by well-meaning officialism is as short-sighted and stupid as it is distressful. Farmers are every year complaining louder of the fact that their pasture lands on either side the road are diminished in value and made positively harmful to their feeding cattle by the dust that is cast upon them by motor traffic. The cleaning up of our roadside wastes and the indiscriminate and merciless cutting down of roadside hedges means the doing away of the only screen that existed between the roadside and their meadow grass.

The inhabitants of many parts of our island depend upon the attractions of the scenery and its natural beauty for their very existence. We cannot have tourists coming to spend their money in the holiday season in the more beautiful rural parts of England unless we safeguard the picturesqueness of those parts and the wild-flower and tree life for their enjoyment. Several County Councils have passed by-laws for the protection of wild plants, which have, we are assured, proved already most beneficial in protecting wild-flower life on the highways. Why should not other County Councils follow a good example? On practical grounds let us conserve the poetry of the road.

There is one other matter to which our county highway authorities may well have their attention called if we wish to conserve the restfulness and the beauty of our highways. I refer to the unsightly advertisement boards and signs which pushful hotel keepers, or ambitious vendors of patent medicines, or the enthusiastic makers of motor tyres are always anxious to decorate our roadsides with, just in the most conspicuous places, and in the places where they will do most harm to the surrounding scene.

I would urge that the highway authorities, who are the guardians of our roads, should feel it their plain duty to put into force in their area the powers that a late Act has conferred upon them of scheduling their roads, or a whole district of peculiar beauty through which their roads pass, as places where these

advertisement boards within a certain distance of the road are absolutely illegal. No time should be lost in getting county by-laws passed against this advertisement peril. Already Westmorland* has done so; I trust other counties famed for the beauty of their scenery and delight of their roads will follow a good example.

But unless public opinion can be roused to a sense of this needless destruction of wayside amenity there will pass away from our land one of the chief delights of those who use our roads, and the poetry and pleasure of a country walk will largely cease to be.

PAPER 22: BY WILLIAM HARPUR, M.INST.C.E., F.S.I., PAST PRESIDENT AND MEMBER OF COUNCIL OF THE INCORPORATED ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS, CITY ENGINEER AND SURVEYOR OF CARDIFF.

Width of Roads and Provision of Footpaths.

The subject which the writer has to deal with does not embrace forms of road or details of construction, but it is inevitable that the question at least of the form or contour of the surface must, to some extent, be referred to in dealing with a topic such as that under consideration, and the writer, while avoiding as far as possible intruding upon other subjects, hopes to be excused if his observations seem to trench upon the range of other writers' papers.

In deciding upon the question of width of roads and provision of footpaths, it is necessary to take into consideration the character and degree of traffic to be provided for, not only in the immediate future, but by forecasting as far as possible the traffic likely to arise in future generations.

The revolution in public road traffic during the past few years by the introduction of road locomotives, mechanically-driven carriages, electric street tramways, and light railways, has called for immediate changes in the matter of road construction, and particularly in the direction of the subject of this paper.

While, until a few years ago, country roads were safe for the pedestrian without the provision of footpaths, and the main road authorities considered it no part of their duty to make any such provision, things have so changed that few roads are now safe to the pedestrian, and the necessity of providing footpaths is a

* The following by-laws for preventing the exhibition of advertisements disfiguring the natural beauty of a landscape have been adopted by the Westmorland County Council:

"1. No advertisement shall in any of the districts hereinafter specified be exhibited in any place visible from any highway or public path on any hoarding, stand, or other erection, so placed as to disfigure the natural beauty of any landscape. The districts to which this by-law shall apply are:

"(a) In the Lake District.—The parishes of Barton, Martindale, Hartsop and Patterdale, Grasmere, Langdale, Rydal, and Loughrigg, Ambleside, Troutbeck, Windermere, and Undermillbeck.

"(b) In the neighbourhood of Morecambe Bay.—The parishes of Arncliffe, Beetham, Haverbrack, Heversham, Levens, and Witherslack.

"2. Nothing in these by-laws shall apply to any hoarding or similar structure in use for advertising purposes at the date of the confirmation of these by-laws, or to any advertisement exhibited at such date, or a period of five years from that date; but at the expiration of such period the by-laws shall apply to any such hoarding or structure or advertisement as if the same were to be first erected, used, or exhibited subsequently to such period, and as if the person using the hoarding or structure were the person intending to erect or use the hoarding or structure.

natural sequence to recent legislation which sanctioned the running of mechanically-driven vehicles at high speeds on the public roads of the kingdom.

In considering the question of width of public roads it is necessary to ignore the rules laid down in the Model By-laws of the Local Government Board, which seem to have been framed for the purpose of providing the minimum amount of air space required about buildings, and without consideration of the necessary provision for street traffic, and the multifarious purposes to which our highways are put in the interests of the general public: including underground—the necessary public sewers and drains, water and gas mains and pipes, electric lighting and power conduits, telegraph and telephone cables; and above ground—street tramways and light railways, street lamp posts, finger posts, tramway poles, and other ever-increasing commodities necessary for the public good, and as the necessities for these ever-increasing demands arise greater widths of roads and footpaths will inevitably be required.

The writer has heard it said that the Model By-laws, which provide for a minimum 36 ft. width of street, is the provision necessary in a country—or small or sparsely populated—area, and that to provide wider streets for such a district is unnecessary, and would be a waste of land. Such an exclamation is most fallacious, for every large town commences its career in a small village or town, and it is from small beginnings that the large towns arise. It is impossible almost to foresee whether a small town may or may not, in the course of time, grow into a large town or city, hence the necessity in commencing the lay-out of the smallest town or city upon broad lines, having in view its possible development into a great populated area, for, in a country district, at the commencement of the creation of a town, land is plentiful and cheap, and it is no hardship to the landowner in requiring him, as his land develops from agricultural to building land, to provide for wider streets and the exigencies of traffic which may arise thereafter. Even assuming that a country district never did develop into anything more than a village, what could one imagine more beautiful than the setting back of the dwellings and other buildings on either side of a broad road, which need not necessarily at the time be extravagantly laid out by the construction of a roadway as for a first-class street of the heaviest traffic, but where the carriage road may, for the time being, be constructed wide enough for two lines of vehicles, with at least one footpath, and ample grass verges on either side, leaving provision for the subsequent construction of a road along the main artery of the town as for Class "A" suggested hereafter, and if the village never developed beyond that stage what beauty would be added to it without the incurrence of any extravagant expenditure.

Other roads should be similarly provided during the development of a village into a town, of Class "B" or "C," so that its growth might be designed upon proper lines for future expansion.

If Councils would consider the question of building development along the main roads of the country in this light, and ensure proper provision for possible future contingencies, the writer does not think there would be much difficulty in obtaining the necessary land free of cost, so as to make proper provision for the time to

come, especially from the large and wealthy landowners of the country, who generally look upon a scheme of this sort with favour, and are mostly willing to help such proposals forward. It should, however, be within the legal right of road authorities, where landowners are not prepared to meet these requirements, to insist upon such provision as the writer suggests, particularly as in country districts, as previously stated, land is of comparatively small value, and therefore provision should be made at the commencement for wide roads without stint, so that a proper beginning will have been made for the growing up of populous centres and the necessity of purchasing properties and buildings at fabulous cost would in after years be avoided.

In considering such a subject as that under review, it must be regarded from the standpoint of the future, without thought of the past or present, as it would be useless to consider the width of roads and provision of footpaths in districts already populated, and it is from the future standpoint, and that standpoint alone, that the writer has considered this question.

In deciding upon the width of roads and provision of footpaths, one necessarily must treat the question from the standpoint as to what traffic, so far as can possibly be conceived, is likely to arise upon the roads to be laid out. It is not necessary that all roads and footpaths should be of the same dimensions.

It has been advocated by some that there should be more than one road, or that certain roads should be divided into sections for different classes of traffic. The writer, however, is of opinion that there should be but one road for all kinds of traffic, provided it is of sufficient dimensions to meet the requirements, always excepting street tramways and light railways, which will be referred to hereafter, and which should not be constructed, except where inevitable, upon the roads available for other kinds of traffic, especially in these days of heavy mechanically-propelled and fast motor vehicles.

The writer considers that there should be at least four classes of roads. Class "A" providing for a roadway, 36 ft. wide, for four lines of vehicles, with a space on either side thereof for a street tramway or light railway 10 ft. in width, and beyond that on either side a footpath of 12 ft. in width, and that in building operations along the main roads of the country these should be the minimum dimensions to be looked for in the future.

One of the reasons why the writer advocates this form of construction is that upon street tramways and light railways the vehicles cannot diverge from the lines of rails laid down like other vehicles, and cannot adapt themselves to other general traffic conditions; besides, the cars are large and bulky, and more or less obstructive to the general traffic of the road. For that reason tramways should be laid down, except at street crossings and such other inevitable places, upon the outer or kerb side of the elevated footpath, and free from the line of other vehicular traffic. Another reason why the writer suggests this position for tramways (see Diagram "A") is that it would enable the tramway, or light railway, to be constructed upon a dry ballast foundation and wooden sleepers, similar to the foundations of a railway, at a much less cost than is now possible, it would reduce the expenditure on construction and maintenance of the tramway system to a minimum, and result in the construction of many

undertakings of the kind in places where the present costly method is prohibitive.

Class "B" would be for the same class of traffic as Class "A," omitting the provision for tramways where they will not be required, but consisting of a carriageway 36 ft. in width for four lines of vehicles, with footways of 12 ft. in width on either side. Other roads of even greater dimensions may be necessary in places where it can be foreseen that great cities and manufacturing areas are likely to grow up; such wider roads should be contemplated particularly in the neighbourhood of docks, harbours, manufactories, railway goods depôts, etc., where traffic is likely to be very heavy, requiring greater provision up to five or six lines of vehicles, while in such places where the vehicular traffic would be likely to predominate a lesser width of footpath than 12 ft. may be permissible. On the other hand, in shopping centres, approaches to railway passenger stations, and places of public resort, where the foot traffic is likely to predominate, greater width of footways than those suggested would be a wise provision; but in matters of such details it is impossible to foresee requirements far enough ahead, and therefore if provision is made, as has been previously suggested, upon all main roads of the country for roads of Class "A," with proper thought and consideration in future planning, a good beginning will have been made upon sound lines for developments which may follow, when circumstances must dictate as to such modifications as may appear desirable.

Class "C" provides for a roadway, 27 ft. in width, for three lines of vehicles, leaving ample space for the regular traffic, consisting of one line of vehicles going in each direction and room for passing, with the provision of a footpath on either side thereof, each 7 ft. wide.

For rural districts where there is little prospect of an urban population or anything beyond purely rural traffic arising, there should be a roadway sufficiently wide for two lines of vehicles (18 ft. in width), with one footway of 7 ft. (see Diagram "D"), always bearing in mind that upon the least sign of the development of any rural area into an urban district through the sinking of coal mines, or the construction of docks, harbours, manufactories, or works, and before buildings are erected, provision should be made for the widening and reconstructing of the roads in the neighbourhood of the class necessary to meet the exigencies of the case.

In rural districts where urban conditions are not likely to arise but where light railways are to be constructed, a roadway of Class "E"—which is a modification of Class "D" with a light railway alongside—is to be recommended. The light railway, instead of being constructed on the road surface, should be laid to one side as shown on Diagram "E," the roadway and footpaths being of the same widths as recommended for Class "D."

The writer submits the suggestion that all developments in the width of roads and the provision of footpaths in the future should be on the lines indicated, and every effort should be made forthwith to provide for some such accommodation, particularly upon the main roads of the country in the districts which are developing into populated areas, and unless this is done discredit must in years to come fall upon the present generation and those now responsible for the provision and upkeep of the roads of the kingdom.

PAPER 23 : BY WALTER J. FLETCHER, M.INST.C.E., F.R.I.B.A.,
COUNTY SURVEYOR OF DORSET.

Width of Roads and Provision of Footpaths.

In penning these few lines at the invitation of the Committee, for the purpose of introducing these subjects to the Conference, the writer wishes it to be understood that his remarks apply principally to *rural* main roads, which, in his opinion, are the roads mostly concerned in these matters.

The advantages of sufficiently wide roads in these days of rapidly moving traffic must be apparent to everyone, and more especially so when the enormous increase in the number, as well as the varied description and character, of vehicles using the roads at the present time, is taken into account.

At the Paris International Congress it was agreed that the width of roads for vehicular traffic should not be less than 6 metres, or 19 ft. 8 in., and there is no doubt everyone will fall in with this; but in many cases on purely rural main roads it would be impossible to obtain even such a reasonable width as this, without carrying out works which would entail the outlay of very large sums of money, which under existing conditions would have to be provided out of the county rates.

By the General Turnpike Act all new lengths of road were to be set out 60 ft. in width, although, of course, this did not apply to cases where existing highways were adopted and taken over by turnpike trusts, and the widths of which were already defined.

After the introduction of railways, and the consequent gradual extinction of stage coaches, etc., the turnpike roads began to be less used, and for reasons of economy the metalled surfaces were little by little reduced in width. During recent years, owing to the great increase in motor traffic, and the necessity that has arisen for wider roads, the original width has been as far as possible restored.

Owing to the passing of the Highways and Locomotives (Amendment) Act, by which "main roads" were first called into existence, many roads were, under Section 15 of that Act, declared "main roads" which are very much below the suggested minimum width of 20 ft. The writer has in his mind one striking example of such a road in his own county, which has a length of about 12 miles, with only an average width of 14 ft. (and in places only 12 ft.), which connects five or six important villages with the market town, the widening of which would involve the expenditure of a large sum of money, as for a great part of its length the road lies between high banks, and in the village streets the houses abut closely on the road, making any widening impossible without rebuilding the houses, etc.

No opportunity should, however, be lost of improving the widths of all narrow rural main roads by piping and filling in the side ditches, and filling up and widening out the quarters of the roads wherever possible.

FOOTPATHS.

With regard to the provision of footways, these are more than ever necessary in the present day, owing to the increased number of motorcars and motor lorries, etc., that now travel on the

roads ; especially are they required through villages and on roads connecting villages with the towns.

In recent years it has been the practice in the county the writer is connected with to require the contribution of a moiety of the entire cost of constructing any new footway on any rural or urban main road from those living in the locality who will chiefly benefit by it, which has answered so far very well.

DISCUSSION.

Mr. B. K. FINNEMORE (Indian Public Works Department) remarked that after the Road Congress which was held in Paris in October last, through the kindness of several county, municipal, and other engineers in charge of roads in this country, he went over some hundreds of miles of roads with a view to gaining some up-to-date information regarding road maintenance. He was much struck with the general excellence of the surface of these roads, and from what he saw of the main county roads then and seven years before he should say they were now in distinctly better order than they formerly were. This improvement, as was to be expected in view of the increased traffic on them, had only been effected by a large increase in expenditure, and the problem now to be faced was how to keep them in their present condition without any future increase or with a reduced expenditure. He found many miles of the roads which had been surfaced with good granite and basalt metal in almost perfect order, and where such surfaces had been tar painted or sprayed an efficient remedy for the dust nuisance as well as a preservative of the surface productive of economy in maintenance appeared to have been found. This held good until the winter came, with frosts and long periods of wet and dull weather. This in some situations destroyed the tar rapidly, and for some months the tar-treated surface seemed little better than that not treated, and a fresh coating of tar became necessary as soon as drier weather came. The tar-surface treatment of the softer stones was much less efficacious, the tar surface coming off a limestone road in large flakes under traffic very quickly. Of the various materials laid with a bituminous binder, tarmac or tar-treated slag appeared the most generally successful under moderately heavy traffic, and he was very much struck in wet weather with the very clean road this gave, when an ordinary macadam or even tar-sprayed macadam road was very muddy. He also noticed the very smooth surface it gave apparently from the time it was put down until worn right through. He noticed that Mr. Carpenter in his paper stated he considered tarmac the best of the materials of this nature

he had used. It would be interesting to know the traffic expressed, as suggested by Mr. Brodie in his paper, in tonnage per yard of width of the roads on which Mr. Carpenter had found tarmac so successful. He had seen some excellent tar macadam and some miserable failures. This pointed, he thought, to the urgent necessity for the standardisation of materials so strongly advocated by Mr. Brodie at the Paris Congress. The excellent results which he saw obtained by Mr. Brodie at Liverpool showed that it was possible to obtain a bituminous binder which was entirely satisfactory, even with the hardest granite, and it was in this direction he thought that they must look for a solution of the problem before them, and he would look with much interest for the results of the further experiments which Mr. Brodie had been making. Mr. Carpenter in his paper had suggested that on roads used by constant locomotive traffic the size of the road metal should be increased to $2\frac{1}{2}$ in. or 3 in. This he must deprecate. He had found that with trap, an exceedingly tough and hard basalt which they used largely for road metal in Bengal, it was not possible to obtain a smooth surface if the metal exceeded even $1\frac{1}{2}$ in. gauge, and with really good tough stone—and he thought none other should be used on roads subjected to heavy traffic—any metal larger than this should be excluded from the upper layer. It would be a retrograde step to recommend an increase in the size to which the stone should be broken. Regarding foundations, the amount of elasticity to be provided was, he thought, a question needing careful consideration. It was quite possible to have a road foundation too unyielding. To take an extreme case, he had always found a metalled surface laid direct on a hard rock cutting exceedingly hard to maintain. On the other hand, he believed some excellent results had been attained by the Trinidad Asphalte Company, where they had used a bituminous binder below their asphalt instead of the usual cement concrete. Before he sat down he wished to thank the road engineers in this country who had so kindly given him so much valuable information, which he trusted might tend to the improvement of their roads in India.

Mr. GULLAN (Belfast) said they found in the city with which he was connected that one of the things they were faced with was how to deal with the heavy traffic that was rapidly developing in motor and lighter traffic. They found that the present structure of roads was absolutely unsuitable, more particularly as regarded the foundations, which possibly 10 or 15 years ago were quite able to support the traffic of those days, but were now entirely unable to withstand the heavier weight. In a road which cost anything up to 1s. a yard or over, the question arose whether the structure should be entirely altered if it was a macadam road at the present time. Mr. Stilgoe in his paper went fully into that point, and he (the speaker) thought it was a most important one, particularly in relation to macadam. If a road cost over 1s. a yard, he

thought it was advisable to consider its conversion into a road of a more permanent form.

Colonel CROMPTON, speaking upon Mr. Blair's paper (see p. 5), said the author conveyed the idea that yellow deal wore better than hard wood blocks in London. This might be true at St. Pancras—the instance quoted—but it did not apply to other parts of London. The late surveyor of Kingston—his own parish—held strong views on that subject, and he knew that his soft wood paving maintained itself in perfect condition much longer than hard wood, though he had not the exact figures. He thought there should be a contradiction of the statement about the greasy condition of tar macadam. It might be true if tar was used in certain forms, and if certain stone was used, but as a general statement it was not accurate, and ought to be contradicted. He made the statement with considerable confidence that, if properly treated, tar macadam did not become objectionable either in wet or dry weather. This was the experience of a large number of road authorities, and the result of his personal observation.

Mr. WILLIS (Chiswick) thought they ought to thank Mr. Blair for the useful table he had drawn up with respect to the durability of different classes of pavement, and the usefulness of such a compilation might be very much increased if engineers as a body provided them with similar information with respect to places where the traffic was considerable. He (the speaker) had one of the principal roads out of London in his care, on which, unfortunately, there was a tramway very much used. Both hard wood and soft wood were laid down. As was known to the engineer, there was always trouble with hard wood blocks, and occasionally with soft wood. Hard wood was continually wearing into holes. It would be advantageous for engineers to know the number of times it became necessary to dress tar macadam. He had an excellent road last year under very heavy traffic, and he found it necessary to re-dress it this year. It would be helpful if they were supplied with some data on that particular matter.

Mr. HARRISON (Southwark) said he had had a considerable experience in hard wood and a certain amount in soft wood. Each wood was put down in the place most suitable for it, and he quite agreed with Mr. Blair as to the wear of soft wood under certain conditions. In a street with heavy traffic and a tramway soft wood would not stand so well as hard, for if the traffic went for the most part in a certain line the wear was shown in soft wood much more than in hard. In one case, in the Borough High-street, soft wood was laid for five years, but they had hard wood in places where tramways were running which had been laid for 16 years. His view was that they must select suitable places for each wood. With respect to tar paving, his feeling was that they must get something better than ordinary tar. They must go more in the direction of a bituminous substance. What they wanted above all was a system of standardisation.

Mr. BRODIE said his friend Mr. Blair had given a table showing the life and wear of different classes of roads in his district, and that raised a point which he should like to mention. There were three or four papers before the Conference dealing with the question of traffic, and each of the authors dealt with the matter from a different point of view, using a different standard. He had been doing his best to compare the results obtained in the papers, but he found from the information given that it was practically impossible to get a comparison between the results. In the circumstances he should like to suggest for the consideration of the Conference that they should settle on one form of traffic return, and ask the gentlemen before the completion of the session to rearrange their papers, if they would be good enough to do this, and give results on one basis that might be compared. In his paper he had reduced the standard to the tonnage per yard of width per street per annum. This appeared to him a most reasonable basis for comparison, because most of them were interested in the cost of street or road surfaces per annum. He had, therefore, turned all his returns into tonnage, as he had stated. Mr. Stilgoe, he noticed, dealt with it at per yard per width per day. Engineers might settle which of the standards were to be accepted, and he should like to see the matter settled, so that they might understand what they were driving at. Mr. Blair stated that in normal conditions the cross-fall on a granite-paved road was fixed at 1 in 30 to 1 in 36. He (the speaker) did not quite agree. He found at Liverpool that 1 in 30 to 1 in 36 was too steep for heavy traffic. His practice was 1 in 48 to 1 in 68, and even with the former he thought they would find a tendency for the traffic to slide down to the channel.

Mr. WAKELAM remarked that Mr. Blair's experiences with respect to soft wood and in connection with wood paving generally were very different to his own. On the Acton road, one of the heaviest out of London, they had a soft wood paving road between 12 and 13 years, and to-day there were practically two more years of life in it. On the same road, in the centre, there was a double line of tramways, and during a period of 12 years the hard wood with which the tramway was laid had been relaid twice, so that his experience was absolutely contrary to that of Mr. Blair's. As to tar macadam and its greasiness, to which Colonel Crompton had alluded, his experience did not agree with that gentleman's. They laid down tar macadam, and found that the road foreman was constantly called out of bed in the morning to sand the road for frost. After a dew a sort of film formed on the surface, and this also necessitated constant cleansing, and the complaints were such that they had to take the tar macadam away altogether. They had made several experiments in connection with tar macadam, and in a good reach of road, with everything in its favour, it stood pretty well. At the time those lengths of tar macadam were laid he laid ordinary

metal alongside of it, water bound, and this was standing equally well with the tar macadam. It appeared to him that from the commercial point of view tar macadam was not a great catch.

Mr. SHRAPNELL SMITH (Commercial Motor Users Association) observed that under conditions of 1 in 30 a van or 'bus could not be kept from sliding into the kerb. It was a serious thing from the user's point of view when the cross-fall was 1 in 30, or even steeper. They did not want the traffic concentrated on one track or section of the road. As to tramcars in the centre of the road, they very much interfered with the haulage contractor and the user of heavy transport generally.

Mr. BLAIR, in reply to the discussion, said the limit of 1s. as the cost of a macadam road was somewhat low. He had frequently heard of 2s., and there were not many towns where it could be maintained at 1s. As to Colonel Crompton's criticism of his statement with respect to the life of yellow deal, the case he mentioned was quite specific. It was a case outside the West Strand post office, where 400 'buses stopped per hour, and the life of yellow deal there was practically only one year, while hard wood wore $2\frac{1}{2}$ in. in three years. The life of wood depended upon the traffic, and it might be taken from seven under heavy, to 10, 11, and 12 years under light traffic, or rubber-tyre traffic. Colonel Crompton, he noticed, did not agree with him as to the tendency of tar macadam to become greasy. Well, he could only say that this was a matter of observation. Where tar macadam was continuous, with long lengths of road, it might be firm and free from that greasy influence which he had experienced in comparatively short lengths. He agreed with Mr. Willis as to hard wood wearing into holes, and that it was that determined its life. They had a case of hard wood laid down from 1893 to 1907, a period of 14 years. The bulk of the blocks when removed were 4 in. in depth, but in between the deeper blocks there were holes which caused nasty bumps to traffic, and the road became so generally covered with holes that it was eventually decided to remove the wood. He quite agreed with Mr. Brodie's suggestion as to the desirability of fixing a standard of traffic. They must have a comparable basis, and he agreed that tons per yard of width was the best basis; whether per annum or per day was a matter open for discussion. He gave the number of vehicles as being better and more reliable to those who read the paper. He could quite easily reduce it to tons per yard, because he had his census of vehicles taken with the weight attached. He need not comment upon Mr. Brodie's statement as to the cross-falls, as that to a large extent depended upon the character of the traffic in the locality. He thought that soft wood might run in many cases to 12 years. It wore remarkably smooth, even to only 1 in. thick, and it remained moderately equal on the surface.

Mr. GOODWILLIE (St. Andrews), discussing Mr. F. G. Carpenter's paper (see p. 13), referred to the damage done to roads by farmers carting potatoes and turnips. He had improved matters by getting farmers to lay down tan at the parts where they left the fields for the road, and he thought there should be legislation to make something of the kind compulsory.

Mr. WHYATT (Grimsby) said the problem of road maintenance was a double one, as it affected County Councils with roads having a vast traffic and a small rateable value and county boroughs with roads on which there was an enormous traffic. There was a difference in boroughs in the matter of what they could afford. In some small boroughs a penny rate only produced £1,000, while in other boroughs the same sum brought in from £3,000 to £5,000. This of itself was a factor that accounted for the rapidity of change from one kind of road to another. He thought they were all agreed that tar macadam of some sort was the next stage after ordinary watered macadam, and the question was how soon they could get it converted. He was allowed about £14,000 for highway purposes, and he found that conversion would take fully nine years, which was far too long.

The CHAIRMAN: How many miles?

Mr. WHYATT: About 43 miles. To substitute tar macadam on all their roads would entail an enormous expenditure. He did not know whether the matter was within the province of this section, but he thought they might with advantage seek to bring pressure to bear upon the Local Government Board.

The CHAIRMAN: Speak to the paper, if you please, now.

Mr. WHYATT replied, with respect, that he thought he was speaking to the paper, which included the question of the substitution of tar macadam for ordinary macadam. A shorter and simpler method of obtaining loans for resurfacing at six or seven years' repayment would help them considerably. Perhaps it might be suggested that the Local Government Board should formulate a scheme to reduce the period of obligation, and fix the price per square yard at which surveyors could make their estimates and carry out the work. As to the damage done by pneumatic tyres travelling at a high rate of speed, he noticed that Colonel Crompton said suction was not proved, and he hoped that gentleman would have something to say on that point. As to the suggestion that metal should be increased from $2\frac{1}{2}$ in. to 3 in., he thought it would be a great mistake if it was enlarged to that size. With respect to another point raised by a speaker from Scotland, the Grimsby Rural District Council put advertisements in the papers calling attention to the damage done to roads by farm carts, and reminding farmers that in destroying their own roads they were simply increasing their rates. As to the best way of laying tar macadam, the methods suggested were, no doubt, satisfactory, provided the weather was suitable, but he had found that the process was not a success when it was freezing, or under

snowy conditions; but grouting in fine weather was a great success. He found he could do the work at about 2s. 6d. per yard. He had tried tar spray, but found that for main roads it was quite unsuitable.

Mr. MONCUR (Staffordshire) said the A B C of road maintenance was (a) a dry subsoil, (b) a good foundation, and (c) the use of the best materials for surface repairs. From the point of view of population and rateable value Staffordshire stood fourth, excluding London, therefore they should from the maintenance point of view stand relatively low, but from the rate per mile point of view they stood extremely well. During the last 20 years he never exceeded £24 per mile on main roads, but at the present time their rate was £69 per mile. After devoting a great deal of time to the foundations of the roads they were gradually overtaking the surface coating. Mr. Carpenter suggested increasing the size of the stone for surface coating. He agreed with him, for he considered there would be far less dust if larger stones were used. He had used 3-in. stone on roads carrying heavy mineral traffic which could not have been maintained with 2½-in. or 2¼-in. stone, with admirable results. Throughout his 600 miles of roads he scarified none except in the case of tramway margins where they were extremely narrow. As to the larger mileage, they scarified none, and he had failed to see the necessity of it. They used from 70,000 to 80,000 tons of material.

Mr. DAWSON (Bradford) said he should not like it to go forth that they would like the Local Government Board to set the price for the repair of roads, as had been suggested by one of the speakers. Circumstances and the cost of material varied so much, that it would be absurd to make any such rule.

Mr. H. E. STILGOE (Birmingham) trusted the Local Government Board would never grant loans for the resurfacing of macadamised streets. The great expense attached to road construction and maintenance was, in the majority of cases, due to the fact that the loans were granted for too short a period. Supposing five years were granted for resurfacing a macadam road, the cost of repaying the loan and interest would be enormous.

Colonel DENNISON (Nottingham) endorsed what the last speaker had said about borrowing money. The tendency was to borrow a great deal, and they would suffer for it later. He hoped the system would not be introduced so far as road maintenance was concerned. His experience of tarmac had been very favourable. He knew it was expensive in the first instance, but they were hoping to introduce a system this year that would provide an ideal road. In the main roads of Nottingham they proposed to introduce a centre of tarmac, say 10 ft. or 12 ft. wide, according to the width of the road, the remainder to consist of ordinary macadam. It was at first thought there would be a difficulty with the edge of the tarmac where it joined the ordinary macadam, the idea being that it

was likely to break down under heavy weights; but the surveyor thought this would be obviated, and that a good road would be formed. Of course, they would only be able to do so many miles a year.

Colonel GIBBON would like to see a little more light cast upon tar macadam, for while there had been some great successes with such material, others had proved complete failures. He did not think they had had convincing reasons given why the experiment should be a success in some instances and a failure in others. His opinion was that in the case of tar macadam the bottom of the road must be extra strong. The drawback with the material was the difficulty of repairing it once it broke, for it got into holes, and he did not know how it was to be repaired at all in the winter. He would like to know what was the best form of bituminous material to put in, and also whether it was good to use quicklime. He had done this himself, and, as far as he had seen, he thought the results were good, the road metal used being 2-in. cubes. He had had a considerable length of tar macadam laid which was quite recently exposed to heavy traffic. It was laid with great care, but although it had been down only about a year it was going to pieces.

Mr. BARKER (West Riding), while admitting that it was a matter for congratulation that they should have the benefit of such detailed experiences as were supplied by the discussion, said it was apparent from the papers that no discovery had been made of a cheaper method of road construction. He should like to see some recommendation that the Local Government Board or some other Government department should take up the question of granting to the local authorities more power over the roads. At present tramway and other people came to London and got powers to use the best part of the roadways practically over the heads of the local authorities. He had appeared before a parliamentary committee, and was surprised how little interest the members of that committee took in the position of the county authorities, and how little disposed they were to protect them from the depredations of tramway and other companies. In the West Riding they had about 1,100 main roads, besides subsidiary roads, and spent about £140,000 on the roads. Practically they had no control over the larger part of the expenditure, because all the urban authorities had elected to maintain the roads themselves, and they told the county authority that they had nothing to do with the maintenance except to sign the cheques and pay the bills. He had been interested in going round the local authorities to try and gain some experience of the individuals who carried out the road construction and maintenance, and he found that many of them did not employ men of sufficient quality and experience in the most economical methods of making use of the materials they had to work with. As to side tracks, they had always sought in cases where a tramway authority

had powers to construct that all the margins outside under 7 ft. should be paved by them when they were making the track, and pay them the cost. With regard to tar macadam, they in the West Riding had set aside a large sum of money for three or four years for the purpose of experimenting with that material. They had put down a track 500 or 600 yards in length regardless of expense. The work was well done, and he had visited it weekly for three or four years. He had no fault to find with the foundation, and there was no part of it subsiding. The whole of the surface was also well done; it had been carefully grouted, and it was admired very much owing to its noiselessness and cleanliness. He was sorry to say, however, that the tar macadam was a failure, and that five or six large patches had to be taken up and reconstructed. Unless tar macadam would give them three lives of ordinary macadam, it appeared to him that as county authorities they might suffer by putting it on their roads. He had not found any combination of materials that will coalesce that did not in the long run give two different levels in the same road so long as there were different methods of construction. In conclusion, he would express a hope that some means would be discovered of enabling them to cheapen the cost of the roads.

Mr. F. G. CARPENTER, in reply, said that while the price of tarmac was given in the paper as 4s. 5d. per super yard, it was only fair to say that he was offered a supply at 14s. 9d. per ton delivered in the West Riding, or 3s. 6d. per yard for 4-in. and 2s. 8d. for 3-in. covering. They put down seven or eight different lengths in the Riding, some of which were a success and others a failure. If they could get tar macadam at 3s. 6d. and 2s. 8d., it would be brought within their reach. With respect to the size of the stones, neither 1½-in. nor 2-in. would do for heavy traffic in the West Riding, where they had a large motorcar and traction-engine traffic, which would soon pulverise the smaller stones and lead to much larger expenditure owing to the more rapid destruction of the metal. He advocated the use of the larger metal as being more economical. Something had been said about the damage done to roads by farmers' carts, and he might say that in the West Riding they suffered considerably by foreign soil from the fields being conveyed to the surface of the roads. With respect to the expenses of tar-spraying, he was pleased to say that he had been allowed £1,000 to be used for that purpose, and he thought it was proving itself to be very useful and economical. He found it lengthened the life of the road 20 or 25 per cent. in the case of the experiments he had carried out. On the question of suction, he thought it must be apparent that rubber tyres damaged the roads considerably. As to scarifying, he found that on an uneven hard road it was much better to scarify before the metal was put on, inasmuch as a better surface was obtained thereby.

Mr. PLATT (Rochdale), on Mr. Brodie's paper (see p. 9),

remarked that as regarded bituminous macadam he should like to know something about the quality of the tar used. He believed it had been found necessary to specify the tar through a standard specification, as ordinary tar would not give satisfactory results. As to the author's remarks on small stone surface, he should like to know how much he gave per square yard, and how it compared with ordinary granite paving.

Mr. CHAPMAN (Somerset) inquired what rule the author would advise as to repairing macadam. He should like to know also whether the materials should be absolutely dry and the class of work that could be carried out in absolutely dry weather.

Mr. RACE (Barrow-in-Furness) stated that his predecessor (Mr. Walter Smith, now of Edinburgh) during the time he was at Barrow paid considerable attention to tar macadam. He laid down a great number of experimental lengths of various kinds—tar slag, limestone, tar granite, etc.—as well as tar macadam on Mr. Brodie's system, and though they were not a success in every case, yet the result as a whole was most satisfactory. He thought the cost was about 3s. 10d. or 3s. 11d. per square yard, ordinary water-bound macadam costing roughly 2s. 3d.; but Mr. Walter Smith, he thought, came to the conclusion that 4s. per yard for tar macadam, under Mr. Brodie's system, would in the long run be most beneficial. He (the speaker) considered tar and tar macadam was the standard for all new streets.

Mr. BRODIE, in reply, confessed himself a little disappointed at the discussion, particularly on the first portion of the paper. He put down certain statements with regard to the wear of stone under different conditions which he thought would have elicited an important discussion, and which he still thought were worthy of the consideration of engineers who were responsible for road maintenance. The figures were interesting in this way. He gave the results on the tonnage passing over a road during its life, which he called the tonnage-life. To obtain this he set a man on each side of the road to make a record in a special book of the whole of the vehicles which passed, and he divided the vehicles into classes, so that they knew within a mere trifle what the tonnage was that passed over the road. Dealing with a stone surface first, they found that if it was made perfectly impervious it gave a life of $7\frac{1}{2}$ million tons per yard width of street. That, he thought, was a very excellent result as an average figure. When the same stone was put in the ordinary macadam road they got a figure about 100,000, or 75 times less than the wear of the same stone under the other conditions. When they took the same macadam in a permanent mixture of pitch they got 750,000 tons as the comparative wear of the roads. This showed the improvement of the present stone to the traffic under its best conditions. Mr. Brodie produced a sample of the mixture he alluded to which had been bound in

a road for seven years, and which was still in good condition. They wanted, he proceeded to say, to present the surface of the stone to the wear under the best possible conditions. He could not say what the tonnage-life of that particular sample would be, but it had exceeded the ordinary life of the same stone in an ordinary macadam road. Passing from that to the question of the road surface, he would like to say that he had tried placing cubical stones on the surface of an ordinary macadam road, filling up the whole of the interstices as in ordinary macadam, and rolling it. He got a remarkably good result—better than ordinary stone laid as macadam. The size of the stone was up to $2\frac{3}{4}$ in. to 3 in., and he had also used $2\frac{1}{4}$ in. The cost of the concrete foundation ran to 6s. or 7s. the superficial yard. He had used that more for the surface of a paved street than for macadam, but he gave it as an illustration of what wear they could get from stone under certain conditions. One objection was that it required some considerable time to mature before they could put it in the road. He had paved with cubical stones to a true surface just as it would be in an ordinary paved street, but giving $\frac{3}{4}$ in. of broken stone. He could not give them the result of that experiment, but he might say that he expected a very fine one. Mr. Platt had raised the question of the patching of tar material used in connection with road surface. He took up a number of foundations in Liverpool, which had been down 20 or 25 years, when they were laying the tramways, and some came up in as good condition as on the day it was laid down. He made that the first basis of his specification for pitch and pitch material. He had gone on gradually stiffening up the specification until to-day they got for delivery a pitch and oil of a defined standard, and anything that did not come up to that standard was rejected and removed from the work. Before tar and tar paving was really successful, some such course must be applied to that particular mixture. So long as they were content to take coal tar in the form in which they got it, he ventured to say they would obtain varying results, and they would hardly understand why they got the varying results. If they got a standard of pitch and oil, they would get at something more definite in quality than had been customary in cases of this sort. As to repairing pitch macadam, they found no difficulty in that regard. Some of the pitch macadam had been down $7\frac{1}{2}$ years in a street in which the ordinary macadam had to be repaired every year. That particular piece had never required to be touched during the period he mentioned, and, of course, it well paid for itself in the meantime. They were putting down a road 114 ft. wide, with a tramway track in the centre, a concrete foundation, and a pitch macadam surface, 3 in. deep, laid on the surface of the concrete. It was too soon to say whether it would give a thoroughly satisfactory result, but, like most other people, they were hopeful, judging from past experience. They had got over the difficulty of the weather to a certain

extent, for where the road surface was damp they used blowers which dried the surface of the material underneath, and they were, therefore, able to lay the material at any time, except when the rain was actually falling. As to the manner in which they ascertained the tonnage of the traffic, they got it by taking the weight of the vehicle itself, leaving the weight of the horse out of consideration. He admitted that the horse gave quite as much trouble as the vehicle itself, and he thought that to do the thing properly they ought to take in the weight of the horse as well as the weight of the traffic. He thought a great mistake would be made if this Conference did not push forward as much as it possibly could the question of the standardising of the traffic passing over the roads. The information he was getting by degrees by applying practically mechanical methods of observation to roads was proving conclusively to his mind that the matter must be tackled by engineers as an engineering matter, and not left to haphazard views as to whether one class of material was doing better than another. If they could impress upon the council of the Institution of Civil Engineers the great importance of going into this question, he thought that alone would be a good reason why this Conference should have been held. He did not define pitch and tar because he recognised that the tar distillers were his masters, and that he could not get at them inside their ring fence. He bought pitch to a standard specification. His authority gave him the assistance of a young chemist, and he got that gentleman to analyse and make definite records of everything that happened with reference to pitch in the city. He analysed every cartload of pitch delivered, and he thought he might say that the pitch he was getting now was absolutely of one quality. The great benefit of getting one quality was that when they mixed similar materials in the same way, they expected and got the same result.

The discussion on the paper by Mr. Albert D. Greatorex (see p. 16) was opened by

Colonel CROMPTON, who said that as perhaps the only member of the Council of the Institution of Civil Engineers present it would give him much pleasure to support a resolution coming from that section in favour of standardising the materials of roads. Approaching the subject of weights of the vehicles from the side of the road user, he had been impressed with the influence of the construction of the vehicle on the construction of the road, and felt that many vehicles were unjustly blamed for damage simply because they were large and their total weight was great. No account was taken of the diameters and the size and weight of the wheels that were used. Therefore, for many years past a great deal of attention had been devoted to the best means of improving the wheels of the vehicles that used the roads. When the Local Government Board order was passed which legalised the standard weight and the

width of the wheels he gave evidence on the subject, and he was surprised to find that such a large weight was allowed. He was, therefore, heartily with the author of the paper when he stated that the weight allowed, especially for wheels of small diameter, was too great. He thought that a reduction of the weight might with advantage be carried out to something like three-fourths of the limits allowed on the smaller wheels. He thought an advantage would accrue if, instead of reducing the weight for over 3 in. of width, it should be made exactly in proportion to the diameter—in, of course, larger proportion than the diameter—somewhere in the direction of the square of the diameter. The damage done by wheels reeling on the road was not so much experienced when the roads were in good order as when they were partly worn and had depressions existing in them. Then the question of impact came into play, and the blow the small wheel gave was greater inversely to the square of the diameter. They could go with the author in recommending to the proper authority that the rule as to wheels should be reconsidered, that greater encouragement should be given to increased diameter, and that the matter should be investigated by a joint committee of road users and designers of road vehicles. As to the question of suction, might he assure them that this was merely a question of words. The action was really in the scrubbing or brushing when a soft material was used for the tyre of the vehicle. It was not suction. It could be proved that there was no sucking, but a horizontal lifting action. It was feeble, and did no damage to the materials which held the road together. But when loose the dust was licked into line. It was really of no use to discuss whether suction action existed or not. The action existed, and had a feeble influence, and only destroyed roads when they were in loose condition.

Mr. SHRAPNELL SMITH agreed with the author that some persons broke the law as to vehicles, but he did not believe this was very general. The weights and speeds were carefully gone into in 1904, before the heavy motorcar regulations were issued, and he thought these were being honourably observed in the main by users. Any tractor drawing 13 tons was divided between two trailers, and it was registered under the Act of 1908 as well as under the Heavy Motorcar Order. If they saw a tractor on the road with two trailers, they would find it was properly registered under the Act of 1908. With reference to tar macadam, he would venture to ask whether the material was sufficiently strong to resist the crushing strain and stand up when steam wagons were on the road.

Mr. HORTON (Derbyshire) thought it was regrettable, as the author had pointed out, that the authorities responsible for the Motorcar Order had not taken more stringent action in the matter of weighing vehicles. He quite agreed as to what had been said with respect to the misleading weights upon vehicles. His personal experience was that many of the

weights were grossly misleading. The weights were tons in excess of the weights recorded on the vehicles as being the actual weights. Again, if it was true that small vehicles heavily laden caused injury to the roads, it became a serious matter to see that the law was properly carried out. He was sorry to say that the users of engines did not take so kindly as they might to the correction of errors, for he found he received no thanks for pointing out the extent to which the excesses were going on. His own experience fully confirmed the statement that the excesses were very numerous, and that the roads suffered through them.

Mr. FIRTH (Leeds) was surprised that no one had mentioned a new kind of material—namely, Durax—which, he understood, had been on the Embankment for some years.

The CHAIRMAN requested the speaker to keep to the subject of the paper.

Mr. FIRTH would like to know if there was anybody in the room with a knowledge of the material he alluded to, because if it was a success he was prepared to make use of it.

Mr. NICHOLL (Aberdeen) said they found excessive weights carried every day by motorcars, and when they referred the matter to their law agent they were told that an offence had been committed, but that there was no penalty attached. As to prosecuting, it was rather amusing to find that all they could do was to take out an interdict so that the offence might not occur again. But the worst effects of the order were seen from November to March. In the Aberdeen district last season they had falls of snow averaging 3 ft., with the thermometer considerably below zero. It seemed that the owners of heavy vehicles loved frost and snow. When the roads after such weather were in a state of "plum-pudding" down came a large traction engine and trailers, and the result could be well imagined. There was no macadam made that could stand such usage. The steel tyres of the motor lorries were more destructive than anything else, and in the case of small lorries it was found that they cut an average of 6 in. into the road. They might prosecute for excessive wear and tear, but the difficulty was to find which vehicle had done the damage. On the other hand, the local authority had to face the possibility of an action at law, for after the road had been damaged another vehicle might come along, and compensation was claimed for the horse tumbling into a rut. To his mind it was a most important thing that the Conference should emphatically express the opinion that greater powers should be given to road surveyors to close roads at certain times, because unless they were closed it was impossible at any expense to keep them up.

Mr. GREATOREX, in reply, dealt in the first instance with the remarks of Mr. Shrapnell Smith, and observed that his objection to the heavy weights was that under no circumstances should such heavy weights be carried on roads with such small wheels. He had had tar macadam laid down

for something like three years in the main street in West Bromwich. It stood for 12 months very well indeed. Then they had the surface recoated, and at the present time it was impossible to say that its wearing capacity had been affected. They had heavy traffic in his district, being in the centre of large industries, and he was of opinion that if tar macadam was made in a proper way it would carry the heavy traffic of any district that could be named. The material must be carefully overhauled and not put down haphazard, and a skilful foreman should be placed in charge of the job. A man of experience in that class of work would see that the materials were good, and, above all, that the foundations were of the best. He should like it to be understood that in no shape or form was he antagonistic to motor wagons or cars. He was only too pleased to see the industry in connection with these vehicles increasing. His only object was to draw the attention of his brother surveyors to the larger powers they possessed if they only took the time to carry them into operation.

Mr. HARPUR, discussing Mr. Wakelam's paper on "Construction, Curves, Gradients, and Camber" (see p. 35), said the paper dealt, among other matters, with the super-elevation of curves. In a flat district where there were no steep gradients it was possible to obtain super-elevation at the curves of the roads, but in a hilly district where the gradients were 1 in 10, 1 in 5, or 1 in 6, the super-elevation at the juncture of the roads was a matter of impossibility. Therefore, Mr. Wakelam in his remarks could only be referring to the construction of roads in practically flat districts. The point he particularly wished to have a word about was the author's suggestion in section No. 16 of an elevated platform on which a tramway should be constructed. Without any knowledge that such a suggestion would emanate from Mr. Wakelam, he (the speaker) had made a similar suggestion in his own paper (see p. 59), but with a distinct variation. Mr. Wakelam suggested that the platform on which the tramway should run should be in the centre of the road. He could not but entirely disagree with him. He (the speaker) suggested that the position for the tramway was not in the middle of the road, because that would prevent the traffic from making use of the most important part of the thoroughfare, but on the outer edge of the footway, as on the diagram on the wall marked A. A tramway constructed in the form suggested by Mr. Wakelam practically divided the road into three roads, and took away from the general public the most important part of the road, causing a great deal of difficulty in crossing from side to side, which must inevitably mean a great deal of inconvenience to the traffic. If the suggestion had been in accordance with his own—which he naturally preferred—that the elevated tramway should be constructed on either side of the road, he did not think the difficulty of dealing with the traffic would have been so great,

for that would leave the entire width of the carriageway from kerb to kerb free for the ordinary traffic. There could be no question that tramways were a serious obstruction to the ordinary traffic of towns and districts, and if something could be done to prevent them from taking up the premier position of the road, it would tend to reduce the incidental difficulties, and give more facilities for mechanically-propelled roads than at the present time.

Mr. WAKELAM expressed his regret that there had not been much discussion on his paper. He knew that several members were desirous of discussing the subject, but they happened to be absent, and, of course, they could not wait for them, and as he had a council meeting to attend he must leave shortly. With respect to the point raised by Mr. Harpur, before proceeding to put his own suggestions before the Conference he fully considered the points he had advanced, and he came to the conclusion after much consideration that the centre of the road was the best place for the tramway. The chief objection to the other plan of Mr. Harpur was that the people living in the houses abutting on the tram tracks would naturally object to the noise caused by the trams at their front doors. He felt that with his plan the noise would be more distributed. If the tramway was placed on the side of the road as suggested in cartoon A they not only had the noise, but also the inconvenience in regard to unloading vehicles stopping on the road at houses and places of business. In the Metropolis they found it desirable to have fast traffic separated from slow, and in Section 15 he thought he showed a very good arrangement—he had not seen a better—and it was put forward to meet the difficulties they had at present to contend with in fast traffic that was mixed up with slow to the obstruction of the fast. If they had room for fast traffic in the centre, a great deal of the trouble and difficulty experienced in London and neighbourhood with regard to blockages of traffic would be very considerably minimised. As to the question of gradients, it was mentioned that a gradient of 1 in 30 was sufficient for metal roads. He did not agree that 1 in 30 or 1 in 35 was suitable even for metal roads. He thought that for fast and ordinary traffic it was better to have a gradient as flat as possible compatible with surface drainage and the wear and tear of the roads. There was no greater wear and tear in flat camber—ordinary camber—than in the other. Dealing with the sketches shown on the walls, the speaker proceeded to say he thought it would be interesting to the Conference to give cartoons showing how the roads had evolved from the time of the Romans to the present day. The central cartoon showed his suggestion for the raised platform in connection with the Town Planning Bill. He thought it would be most desirable to acquire sufficient plots (as on the cartoon) for the purpose of beautifying the roads, and when the time came for the removal of the shrubs appearing on the plan they could lay

down tramways without inconvenience to the traffic, they could have their raised platform constructed, or tramway service, and the remaining material would go to the maintenance charges of the corporations. Such an arrangement with the Middlesex system of tramways would probably mean a saving of £20,000 or £30,000 in the maintenance of the tramway tracks alone, apart from the inconvenience of keeping the margins of the tramways in repair. On the whole, he considered the centre of the road was very much better than putting the raised platform at the side. With regard to super-elevation, that was a matter that was coming more into vogue since the introduction of motorcars. Previously it was not considered a very material point in construction or maintenance of the road. He was in a county in the north not very long ago, and was pleased to find that that point had been carried out by a well-known surveyor in the north-eastern part of England, over whose district he had the pleasure of passing. On a motorcar in elevation one was swung from one side of the car to the other, and this came more particularly to his mind as a matter well worthy of the consideration of the Conference in relation to the curvature of roads. He considered that the curves shown on the section were about as good as could be framed for the purpose of vehicles seeing each other at the road corners.

The CHAIRMAN said he was sure they were all obliged to Mr. Wakelam for the cartoons he had provided for their instruction.

It was now agreed to discuss the papers of Mr. Geo. A. Phillips, Mr. J. S. Pickering, Mr. Henry E. Stilgoe, and Mr. W. J. Taylor *en bloc* (see pp. 20, 23, 26, 32).

Sir JOHN MACDONALD (Edinburgh), alluding to the statement in Mr. Pickering's paper that, after rolling and watering, "a patch applied in this manner may not require a shovelful of metal, but it necessitates the application of water and the use of the steam-roller," inquired whether it was practical or successful to patch in small pieces, and whether some other appliance was not required of a simple kind without bringing an enormous steam-roller to bear. Something of the nature of a rammer skilfully applied would surely be better for the purpose.

Mr. STILGOE regarded Mr. Pickering's paper as one of the most important they had before them, on the argument that "a stitch in time saves nine." The proper patching of the roads on scientific principles was most important for the welfare, the length of life, and endurance of the roads. The majority of the patching was done in an ignorant and improper manner. The different patches should be cut out in proper square blocks, the old metal removed, and the new metal put in and rolled down and finished off complete. If these rules were generally observed on macadam roads, he thought the life of the roads would be greatly prolonged. A road was something which everyone understood, or thought:

they understood—which came to the same thing—and he had no doubt that people who had not studied, as road engineers had to do, the subject of the upkeep of the roads considered that any class of work or labour on the roads would do, that old men might be told off to supervise the work, and men in general who did not go into the matter in a scientific manner. On that head he would say that if the principles laid down by Mr. Pickering in his paper were carried out, they would go a long way towards enlightening people as to the repair of macadam roads and add greatly to the length of their life.

Mr. SINCLAIR (Widnes) said the author made reference to the dust nuisance, and that surfaces had been sprinkled with calcium chloride solution, with the result that, although the nuisance had been somewhat minimised, the success had not been great. He (Mr. Sinclair) might say that he was one of the pioneers in the use of calcium chloride for laying dust, having used it since 1904 very successfully. The chief difficulty they had to contend with was to get the solution in a portable form, but personally he had had no difficulty, because he was in a chemical town where the solution could be obtained very easily. He used it at 40 deg. Tw., though he had used it as high as 60 deg. Tw. When used in a proper manner he found there was a great saving in the wear and tear of the roads. When they considered that one application of the solution was equal to 30 applications of water, and that they avoided all the lickiness or mud which the constant application of water gave, the wear and tear must be considerably minimised. As to tar spray for heavy-traffic roads, there was no comparison between the two solutions. He admitted that in a severe gradient, say 1 in 20, there was some amount of slipperiness with calcium chloride, and they had had to get over the difficulty by using sand; but there was no doubt it had a hardening effect on the macadam, and the roads lasted at least 20 per cent. longer.

Mr. BLAIR thought Mr. Stilgoe's ideas on patching were excellent, for to make use of the steam-roller wherever there was patching to be done would be beyond the possibilities of the work of the steam-roller in any district. To reinstate 10,000 or 12,000 patches a year, or some 30 per day, scattered over 90 miles of roads, made it impossible for the steam-roller to travel from one spot to another. He agreed that a stitch in time saved nine, and that the sooner a soft block in a wood road was removed they saved the adjoining blocks, but personally he could not do repairs in that way. The limitations imposed upon him did not permit him to make reconstructions when he thought they were necessary, leaving out repairs altogether. The amount allowed to him for repairs was absurdly small. It might surprise them to know that for the whole of the wood paving in his district it amounted to 2½d. per square yard per annum. They had heard of the cost being ½d., but he had to do it with the sum he had mentioned.

The obvious result was that arrears of work were accumulating, and there was no doubt the cost would be something terrible when these had to be made up. The difficulty of getting uniformity of size with round gravel could be met by crushing flint ballast and spreading it so that a fairly uniform size was obtained, and this he considered better than the round gravel, which did not so rightly find its way as the crushed flint. As to the application of particles of grit and ballast crushed into wood, his experience was that the more the fibre of the wood was destroyed by crushed ballast the sooner would the wood wear out. They had an example of that not far from Charing Cross. There the wood paving was treated with crushed ballast, and the surface almost scaled off to a depth of about $\frac{1}{2}$ in., this being done, as he believed, by the ballast. Before 18 months had elapsed the road—and it was one where the traffic was comparatively light—was an absolute disgrace. Therefore he went further than Mr. Stilgoe in objecting to the application of gravel to wood. But what was there to be used? They had Guernsey or Leicester granite crushed to about $\frac{1}{8}$ in., but this gave rise to a greasy paste, and the last state was worse than the first. Sand also was used, but in a few hours they were quite as badly off as if they had never used it. What, then, could be done to preserve a safe foothold on the roads? His reply was simply cleanliness. When the road was free from dirt, slime, and so forth, they had, as a rule, a good foothold and a good quality surface. With horse traffic there was, of course, a difficulty in maintaining a good quality of surface. In such cases roads washed every night frequently looked as if they had never been washed by noon next day. It would be only when they got automobile traffic, which did not soil and destroy the roads, that they could hope to attain to that condition of cleanliness that would obviate the use of gravel and other kindred materials.

Mr. BRODIE, speaking to Mr. Pickering's paper (see p. 23), said that within limits that gentleman was on the right lines as to repairing the surface of macadam roads by patching. In roads of varying traffic they must deal with the surface very much on the lines of the amount of traffic, or, in other words, the life of a coating before requiring to be reconstructed. In some of their roads in Liverpool patching was entirely out of the question. In 12 months there was only one thing to do, and that was to scarify the whole surface and recoat or deal with it in a proper way. Then there was other traffic where recoating might be required only once in five or six years. In that case they must patch. He thought Mr. Pickering was on sound lines when he tackled the question of patching as an engineer should tackle it. He wanted to send out the steam-roller. He took it his steam-roller was intended to be a combination of steam-roller, watering-cart, and a cart to take materials, to be in charge of an educated man who knew what patching was. To knock over a combination of that sort would be a mistake, and he, therefore, hoped Mr.

Pickering would continue and improve upon the lines which he was following, for he believed that upon a certain class of roads he would obtain very good results from dealing with the matter in the way he described. He (the speaker) only wished a number of engineers would introduce equally independent thought into their work, and let them have a go at the proposals they brought forward. Mr. Stilgoe, in his paper (see p. 26), gave the results and cost of the different types of paving employed in a city such as Birmingham, and he thought the information he offered was really well worthy the study of the Conference. Taking the cost of 6-in. setts and 4-in. cubes over their life—he was assuming they got 30 years' life—he (the speaker) found that the former were 10d. per annum, and the latter 6½d. per annum. Pitch macadam was 3½d., and ordinary macadam about 10½d. He had dealt with those on the basis of the different traffics, because they could not be dealt with in the same way. He had gone a little further, and said what was the cost of this paving per 100,000 tons per yard per annum. He was not prepared to say that the figures he had arrived at were accurate; he would like more time to get the figures over a number of cases before he gave them definitely, but he gave them for what they were worth. Six-inch setts worked out at about 5d. per 100,000 tons traffic per yard width per annum, and 4-in. cubes 4¼d. per 150,000 tons. That was really the limit figure he could apply to find for any type of surface when dealt with on the basis of tonnage-life. Australian hardwood was 10½d., and the combined road about 13d. Pitch macadam came very low, working out at 4½d. per 75,000 tons, and ordinary macadam worked out about 10½d. He thought it would be well if they could get tests per cent. of tons per yard width per annum, for he thought "life" was misleading and wrong from the engineer's point of view.

Mr. PRESCOTT (Eastbourne) remarked that what they wanted to know was the best possible road to construct with as little increase in cost as possible in order to obtain better results than they did at present. They were told in the papers that the best possible method was to lay down an ordinary macadam road, water thoroughly well, and apply to the surface a coating of hot tar. He (the speaker) had had considerable experience in laying tar roads of various kinds. He had experimented to get a dustless road, and he had pinned his faith to tar macadam. He had had his successes, and, like others, he had had his failures. He laid down a length of macadam, and the clerk of the weather knew he wanted to make a success of it, because it started raining and continued for about four days until the foundation became quite saturated. This did not prove a success. He laid down another length of road with the same materials in fine weather, and the road had been down for three years without showing a scratch; and he might add it was a road where the traffic was heavy. If they were to improve their roads at a

minimum cost, he had come to the conclusion that the best way was to lay down a proper water-bound road, combined with dry granite chippings, and then give it a coat of hot tar. He was a great believer in the application of tar by hand. There were a good many machines for that purpose in the market, but his experience went to prove that hand application was much more effective than application by machine. As to the difficulty of dealing with the different companies, water, electricity, and so on, who came along, he thought the most effective way of stopping them would be to get them accidentally under the steam-roller.

Mr. WOOD (East Sussex) said they had been listening to a discussion on roads of various classes in urban and semi-urban districts, large county boroughs, the city of Paris, and around the city of London, but they had heard nothing yet about a most important thing from the point of view of most of them present—viz., how to construct or maintain a macadam road, which had to carry the present-day motorcar traffic. They had their macadam roads, some of them, unfortunately, made years ago, which large County Councils had now to take over and endeavour to maintain in a satisfactory manner with the materials they had placed in their hands. He had a road which was supposed to be laid down with macadam, but he did not think there was a worse road in the county of Sussex. They had had to reconstruct it by putting in a good hard foundation before they could attempt to improve the surface condition. The point to consider now was what kind of surface was the best to meet the traffic, how they were to obtain that surface, and whether it was going to cost more than ordinary macadam had in the past. He agreed with Mr. Prescott with reference to the tar treatment of the surface of the roads, and with Mr. Phillips as to tar spraying giving promise of most economical results. His experience of macadamised roads was that where they were watered continually and regularly they could not stand the traffic anything like so well as roads not watered at all, only proving that if they could waterproof the surface of their roads they would obtain 50 per cent. of the advantage they wished for—namely, a road that would last longer than the present water-bound road did. It was said that the waterproof road could be made at 1d. per yard in excess of the water-bound road. That could be proved to be correct, but 1d. per square yard would have to be expended in the surface maintenance. If a road cost 1s. 6d. per square yard to lay down with good granite macadam bound in the usual way with concrete and water, and was tarred at the cost of 1d. per square yard, and the life of that road with tar would be four years, they would say it would cost them 4½d. per square yard per annum, but during that four years an additional 4d. had been spent for tarring. It had, therefore, cost 1s. 10d. in four years, but having spent the 4d. in tarring they increased the life of the road by two years, and the expenditure was practically the same. But they had to add at the end of

Four years another 1s. 6d. which it would have cost if it had not been tarred, so that in 12 years' time they would have saved 6d. per yard. So that whatever they did as regarded tarring the surface, they must be prepared to spend a little more per annum on the actual maintenance of the roads. He was satisfied that tarring was the best and most economical method brought before the attention of either the Paris or this Conference.

Colonel CROMPTON observed that he could agree heartily with the two previous speakers up to a certain point. He believed that the road problem, under modern conditions, could be best solved by giving each surveyor the best materials he could get, that he should bind these with a small amount of water—in the first instance with concrete and a little of the ordinary binding or hoggin—and that as soon as the weather permitted, with the road dry three-quarters of an inch from the surface, the surface should be treated with tar. But at this point himself and the speakers were divergent. After having carefully observed the behaviour of roads treated by hand and machine, he had come to the conclusion that there was no comparison between the two methods. His works were situated in Chelmsford, and he had had the whole of the roads tarred for two years by hand. During the first year a superficial application of tar was satisfactory, but it had not stood the winter through on account of the exceptionally hard weather, and the small depth which hand painting affected. He had watched those roads with great care, and in London he had watched the behaviour of the Wandsworth roads. For three years experiments had been proceeding in the latter borough—on a small scale three years ago and since then on a larger scale—and he could say without fear of contradiction that the results were absolutely surprising. The roads were treated in the ordinary way up to the application of the tar, but this was not done by hand, but by machine, the agents used being pressure and extreme heat, and roads which used to be coated every year without going a year and a half were now in good condition, and the $\frac{3}{4}$ -in. tar surface not worn through. The cost did not exceed 1d. per square yard. It was difficult to see why tar spraying by machine should have such a different effect compared with hand spraying—that was a question of considerable complexity. It did not matter how hot tar was when poured on the road. By the time it had penetrated the road it was practically cold. It was in a viscous state, and it was only when the road was exceptionally warm or dry that good results were obtained. Under ordinary conditions such results were not obtained. The conditions under machinery were different. The road was dried and brushed and subjected to a strong blast of hot air, which thoroughly cleansed the surface, and left it in a state to drink in the tar. The tar practically disappeared into the road, and there was little left on the surface. He considered that was an ideal way of treating roads, and it was done at the small

cost of 1d. per square yard. He might say that the roads so treated could be inspected in Hertford, on the Great North road, and at Wandsworth. He quite concurred in Mr. Pickering devising a special apparatus for patching. But he patched in the old way. Why not in the new way? In the Great North road they patched with small granite, and it was as good as when laid down two years ago. It was dustless and perfectly satisfactory, the hedges near it remaining green and pleasant to the eye, and showing nothing of the horrible drab appearance caused by most motor traffic. The question of painting and spraying was one that should obtain their careful attention, for under such treatment there was less nuisance, the roads cost less money, and they were much more durable.

Mr. PURSER (Kesteven) congratulated Colonel Crompton on coming round to the opinion of surveyors, for he had a distinct recollection of his announcing that a new system had been established which would supersede everything in the world. He had said nothing about that to-day, however. He (the speaker) agreed with the statement that hand painting of the surface of the road was better than by the machine. He had found hand painting do everything he expected it to do. He had watched it carefully, and was convinced that it had a certain effect on the road for three years. He had to cater for two or three sorts of traffic. Motorists liked a dead smooth road, but they were not the preponderating users of the road. Horse traffic was in the majority, and in the early morning rime and frost took hold of a tar surface, whether sprayed or spread. On the Great North road they did a great amount of patching with tar material, and their people were very pleased with it. There were vehicles on that road that picked it up, chucked it in the eyes of passers-by, and flung it over the hedges. He was in the habit of motoring 10,000 miles every three or four years, and he found that it was desirable to wear goggles if they followed them, because they chucked pebbles the size of marbles in the eyes. These did not come from the car, but the road, and they must, therefore, be damaging the road. From careful observations on the Great North road he was convinced that steel studs were the great sinners; the ordinary tyres did very little damage. Some of the cars travelled at the rate of 50 or 60 miles an hour, and did an immense amount of damage. He advocated a tax on motorcars in order to meet some of the damage they did.

Mr. GULLAN said that, as to tar spray, reference had been made to the climatic conditions when the operation was carried out. Colonel Crompton had stated that the road must be thoroughly dry for the work to be effective, and that it should be dried from $\frac{3}{4}$ in. to 1 in. below the surface. He would like Mr. Phillips to say what his experience was in that regard. In Belfast they had varying climatic conditions; they never knew when they might get a rainfall. Last year they

gave a contract to a firm of tar-spraying experts to carry out certain work. The contract was given in the middle of August, and the representative of the firm remained in the town till the middle of October. Then he was able to make a start, but he had to stop at 12 o'clock in the day on account of the rain, and almost immediately the Corporation received a large number of claims for compensation owing to the destruction caused by mud and tar. The reason he was so interested in this subject was that they were really at issue as to what was the best process—tar macadam or spraying. It seemed to him that tar macadam had advantages over spraying, for it could be put down in damp conditions.

Mr. SMITH (Scarborough) said that with respect to tar macadam their methods at Scarborough appeared to be different to those of the previous speakers. He was speaking of roadways which had to carry only light traffic, and in Scarborough they had in vogue a practice, initiated by his predecessor, of constructing what he called a tar-bound road of a material which should not give the desired result theoretically, but which did in practice. The subsoil of Scarborough was boulder clay, and upon that they placed a layer of 7 in. of sand and brick-paved roadway, with soft local sandstone from the quarries to a depth of 3 in., which was bound with a layer of gravel from the beach. Upon that they put a coating of $2\frac{1}{4}$ in. of local limestone, also obtained from the beach, and a mixture of clinker and tar, the whole being finished with a mixture of fine siftings and grit. This was well rolled in, and cost from 2s. 6d. to 2s. 9d. per super yard. There were many roadways which had been down for 25 years, and all that had been done was to paint them with cold (not hot) tar every three or four, and in some cases five, years. He thought they could claim that was about as low a cost as could be reached for a roadway with such a life, but the economy effected was largely due to the material they got from the beach. They had made successful experiments with painting by hand with cold tar on tar-paved roads, but they could not claim that it had been so successful on dry macadam roads.

Mr. SOUTHWELL (Shropshire) remarked that 1d. per square yard would nearly double the cost of their roads—the cost being £50 per annum. This was absolutely impossible for a county like theirs. What they wanted was to know the best thing to do consistent with their means. It seemed that reconstruction, not surface drainage, was more likely to provide a solution of the difficulty. They had one road tar sprayed, and it had proved fairly satisfactory, and another road had been relaid with tar macadam made on the spot, partly in wet and partly in dry weather, one section being done after the other. The first section done in fine weather was fairly satisfactory, but the section done in wet weather was quite unsatisfactory at the end of 12 months. They had also another experiment in another part of the county with

stone treated at the quarries under cover. It was laid in wet weather, and had been more satisfactory than macadam treated *in situ* also in wet weather.

Sir HERBERT PRAED observed that people would doubtless say he had an axe to grind, but he must say he was not surprised to find there were still people who preferred using tar by hand instead of by machine. He had had a great deal to do with the machine, and found no advantage from it. A great deal more tar could be put in by hand, and the tar remained in the declivities and fresh on the higher parts. The success of the work depended upon the sort of labourers they had. Some men were careful in doing their work, while others put in a great deal more tar than was required. When put in by hand it was very difficult to get tar to run on the road, but he allowed that if the material was put in by machine at high pressure a better distribution could be obtained than was obtained by hand. He had been told that the effect of the tar went off in the winter time. The condition of the roads in Hertfordshire showed that was not the case, except where the machines had done the work. He thought that one of the most useful things would be the standardisation not only of the road surface, but also of the material used. The complaints they heard against road tar generally arose from the fact that it was not proper tar. One of the most experienced road surveyors had told him that his roads would probably become almost permanent from the applications of tar year by year, the life being so prolonged that it might not be necessary to renew the stone for many years.

Mr. PHILLIPS, in replying to the discussion on his paper, said the first point raised was as to the use of calcium chloride. He was afraid his remarks had not been quite understood, as they applied really to country roads, and not to roads that were usually watered. He thought everybody would admit that the watering of roads, except in very dry weather to keep them from breaking up, tended to their destruction; and his point was that all the roads in the county which were not usually watered, but were treated with calcium chloride, were worn into holes. Calcium chloride might be used on hills in boroughs in order to reduce the water bill, but his remarks applied to country roads on which ordinary watering was not done. He did not compare it in point of usefulness with tar spray or tar macadam. As to climatic conditions, he agreed that the drier and hotter the road the more successful would tar spraying be. In Glamorgan they had a heavy rainfall. Taking the average of 10 years, there were probably 80 wet days in the summer months and 100 or 120 in the winter. It was, therefore, difficult to get ideal conditions for carrying out the work. One length of road was treated in Glamorganshire by the tar-spraying machine two years ago under very unfavourable conditions as regarded weather. He scarcely thought there was one

section of the road as dry as he should like it to have been, but notwithstanding that it was not so successfully done as it might have been under more favourable conditions, the residents last year and this year petitioned to have it re-done. With regard to tar painting by hand in comparison with machine work, his experience, as far as it had gone, was in favour of hand painting as long as a mistake was not made in placing the tar on the surface. It should be put on as hot as possible and worked into the road, leaving the least possible skin on the surface. He would like to ask Mr. Pickering whether he had tried his machine on holes or not, and if so, what was the effect upon the water-tank.

Mr. PICKERING, in his reply, said most of the speakers agreed with the system he advocated with regard to the systematic patching of macadamised roads. The first speaker suggested the desirability of consolidating the patches by ramming. He did not know whether that gentleman spoke from experience, but he (Mr. Phillips) believed it to be entirely impracticable. The only way was by rolling. If they rammed, they would have to convey the water to the material for the patching, which would make the process very cumbersome. Mr. Blair rather doubted the usefulness of a roller such as he suggested on the ground that he had too many patches to attend to. To his (the speaker's) mind his was one of the cases where the roller he suggested would be of the greatest service. The only alternative to it was to leave the surface to be consolidated by the traffic. The advantage of the roller, he believed, was that it could travel at such a speed that it could get about the district in order that the patches might be attended to, whereas an ordinary roller was quite impracticable for such purposes. If Mr. Blair had, say, three of these machines, he would find that their cost would soon be repaid. Mr. Brodie rather deprecated the suggestion of the combination of uses to which the roller could be put. Since he had had the machine, nine months ago, he had used it almost entirely for road patching, but he mentioned the combination of uses because in smaller towns, where the cost of an ordinary roller would be too much, it would be useful to do the patching in the winter, and turn it to other purposes, such as street watering, in the summer, or tar spraying by means of a tank inserted instead of the watering-can. He agreed with patching with tar material. Although he had not many holes in his district, he did not see the slightest reason why it should not be done; it could be resorted to wherever the ordinary steam-roller could be used. The roller he used was by Manns' Steam Car Company, Leeds.

Mr. STILGOE, in his reply to the discussion, said Mr. Gullan referred to the period when it was advantageous to convert macadam into a paved road. Without enlarging on that, he simply pointed to the diagram which set out the period. In converting a macadamised road there were a great many circumstances which should be taken into consideration.

There were renewals, the cost of watering, renewals of surface, additional cost of scavenging, and keeping in repair. They would probably say it ought not to be so, but *if they had a smooth surface it must be kept in first-class order as to scavenging.* Mr. Brodie had touched upon a most important matter when he alluded to standardisation, and he (the speaker) trusted a resolution on the subject would be proposed at the end of the Conference. That gentleman also struck the proper note when he spoke about the composition of tar. That was one of the matters in which they were beaten, for they could not get behind the distiller. He got quotations for crude coal-gas tar, and for refined tar, and specified for 2 per cent. of naphthalene, but he found it contained 28 per cent. The distillers admitted this, and said they added other things, and in the additions they would find there was probably more naphthalene than there was crude tar. He had the distillations carried out before him, and it was extraordinary what different results they might get from the same sample by regulating the rate at which the boiling took place, and other considerations. The proof as to whether tar macadam would stand entirely depended on the materials, alike as to the stone, the tar, or the other ingredients mixed with it. One speaker asked why in certain cases the surface of the tar opened out, and spaces made their appearance. If he looked into the matter, he would find there was a bad bottom in these particular parts, or some old trench, the foundations of which, not being so strong as the rest of the road, caused the tar to give way. If they came to look into the reason why tar macadam did not stand, they had only to carry the mind back to the old system of mixing the material. The stone was heated up to a considerable heat, the dust was sifted from it, *and boiling tar was added to the stone, the stone being at such a temperature as to have the pores thoroughly open, and not so hot as to spoil the tar.* The state of the road depended upon the proper materials being used: it was impossible to know whether it would stand unless they knew what it was composed of, and how it was made. A great deal had been said about the relative advantages of tar painting roads by hand and painting by machinery. So far as the great towns were concerned, they could not think of waiting while tar painting was done by hand, whether it was good or not, because of the expense in lighting and watching. He felt certain that where good results were obtained from tar painting—and he had obtained them—they had been due to the fact that the tar used had been boiled, and refined in the process. If they used crude tar in a tar-spraying machine, they did not obtain as good results as when they used refined tar. The point was raised as to what was called the wheel roughing on the road surface. The term was not used in its ordinary meaning, because they knew it might be a tractive effort, and not roughing. This might be exemplified in a wood-paved

road. If they made an examination they would find an S groove in the direction of the traffic, which was not caused by the slow but the heavy traffic. They would see it on the landing stage at Liverpool, and many of the streets in Birmingham, and this was caused by the tractive effort. The greater relative damage was caused by the speed rather than the weight of motors. They got light tractors going from eight to ten miles an hour, and causing infinite damage. Mr. Blair dealt with the question of gritting wood paving, and referred to the statement that he (the speaker) said round gravel should not be used. He had placed on the table a soft-wood block in which they would see round gravel stones on the top, but worn off, and the stones driven into the fibre. The best kind of material he obtained for the purpose was a clean stone which neither went into the block or cycle tyres. A great and important point was to see that they had foundations to the roads. It was idle to expect a badly-made road to become a good one by adding fresh macadam to the surface without a good foundation. The main thing in connection with the condition of a road was the foundation or the lack of the same.

Mr. TAYLOR, in his reply, said he contented himself with the hope that the Conference was at one with him in condemning small wheels, studded tyres, and a central track.

Mr. SHAND, speaking to Colonel Crompton's paper (see p. 45), said he thought the author had taken a too limited view of the stress put by motorcars on the road. He stated that a suction action did not take place. It did not matter where it was sucking by vacuum; there was a tremendous air current and sucking produced by motorcars which had an enormous effect upon the road by driving out the binding materials. The road thus became disintegrated, and the next vehicle that came along, whether heavy or light, would pick them up, or, finding them all loose, grind the particles together by attrition. The only other thing he would like to point out was that they did find the roads were rubbed round, so that even on a smooth surface they found them pulled up by motor traffic. In the part where the wheels went they got tremendous hollows which entirely destroyed the road. They must take the effect of the motorcar passing as a whole, and see that they got the road as far as possible free from movement.

Mr. WILLIS (Chiswick) thought the roads would be greatly relieved if the vehicles were brought to a higher perfection.

Colonel CROMPTON, in reply, remarked that if they supposed—and it was undoubtedly capable of proof—that the real damage to the road by traffic was caused by crushing quite apart from the extreme speed, the 2,500 lb. per square inch as the maximum pressure was that caused by a rigid wheel, while 250 lb. (small) maximum pressure was caused by solid rubber, and 50 lb. or 80 lb. by pneumatic tyres, groove A. As regarded the reduction of wheel diameter, that applied to rigid steel wheels, but hardly to soft-tyre wheels. As to the

use of the term "suction," it was admitted that action did take place. He did not think it would be many years now before all roads would be made waterproof. So long as they were water bound they were at the mercy of the climate. He had been rather twitted because he said nothing about Mr. Gladwell's promising system. Surely he could not be expected to talk about everything. He thought he had talked too much, but when one was anxious to bring users into touch with road-makers one naturally touched upon a great many matters seen from many points of view.

Mr. BRODIE, in discussing Sir J. H. A. Macdonald's paper (see p. 5), gave his personal experience of horseshoes as against rubber tyres. On a particular street in Liverpool they had practically no pneumatic-tyre traffic up to five years ago. The life of the road was one year; it had to be recoated with macadam every year. The vehicles consisted of hansom cabs, horse omnibuses, and light traffic. The nature of the traffic had, of course, changed with the introduction of motors, but the total tonnage was almost the same. The cost of maintenance, too, was almost exactly the same, but a difference of the conditions had arisen. In former days, with iron-wheel traffic, they had the stones on the surface properly worn, and they put their coating on without increasing the depth of the road surface. During the past two years he had been devoting special attention to the road, and he found that while they were still putting on the same thickness of stone the crown of the road had risen. There must be a reason for this. They found that apparently the pneumatic tyres and the speed of the motors caused a grinding action below the surface of the road which did not exist previously. It was necessary to remove a considerable proportion of the fine material in the road, practically 50 per cent. of which was less than $\frac{3}{16}$ in. in diameter, although it had been put in as $1\frac{1}{2}$ -in. material.

Mr. BALLANTINE (Stirlingshire) said that perhaps the author's remarks applied to farm roads or avenues. He had seen tracks made by horses' feet in such roads, but he did not find the same in ordinary roads. He had found it necessary to repair the wheel tracks three or four times before the centre of the road, so that it appeared to be wheels rather than horseshoes that did the damage.

Lord MONTAGU had had a rather interesting experience, which confirmed that of the author in roadmaking. He had two or three miles of new road made, mainly with a view to motorcar traffic, one part of which was used by horse traffic. The motorcar traffic hardly wore the road at all in the tracks where the wheels went, whereas the part where the horse traffic went was worn hollow in the middle, and, as it were, dug out. The same experience would have been noted by many people, and if on broader and main roads motorists would not keep exactly to a track, like their predecessors, he thought the wear would be minimised.

Mr. DRUMMOND (Renfrewshire) offered his congratulations to Sir John Macdonald, who was the father of road surveyors in Scotland, and kept them all right.

Sir J. H. A. MACDONALD, in replying, said they would be able to note from the last speech that Scotsmen stuck close together. He took a great interest in roads, not because of motoring, but because he had been a driver since he was fourteen, and knew what roads were in those days compared with what they were now. He agreed with his other friend from Scotland (Mr. Ballantine) that the wheel did most damage. All he (the speaker) said was that the horse aggravated it. In his early days the railways made it plain that it was not worth while spending much money on the roads, because they could walk miles in the country without seeing anybody. The road was coming into fashion again not merely for motorists, but also for horse traffic, and he was sure it would be realised that commercially good roads were invaluable to the country; and if, as everybody now admitted, there would be an enormous increase of motor traffic for carrying persons and goods, roads should be made sufficient, at whatever cost, to carry the traffic. By this means the rate-paying powers of the people would be increased, the prosperity of the country would be increased, and any such tremendous deficits as they had to-day would be unknown in their annual Budgets.

Mr. GIBBONS (Gloucester County Council), referring to Mr. Harpur's paper (see p. 59), remarked that the provision of footpaths was becoming more necessary than formerly. He was disappointed not to see any reference made to the best materials for making footpaths.

Mr. WHYATT (Grimsby) was of opinion that with tramcars run at the side of the road there should be more room for the foot passengers. He thought that Mr. Wakelam's raised tramway was in a very dangerous position.

Mr. HARPUR, in reply, said the question of material did not come within the subject of the paper, and it was not desirable to discuss a subject he had not dealt with. As to the position of the tramway, he had considered the matter very carefully from all points of view in cases where streets were not already formed. In his opinion, to place a raised track in the centre of the road was a great mistake, and would form a considerable obstruction to the other traffic of the road. The main traffic should be as free from obstruction as possible, and there should be one road of ample dimensions to meet the requirements of all kinds of traffic. He considered that his plan would result in the least obstruction to the traffic. As to the width of the carriage road, that should be determined by the particular class of vehicles the road had to carry.

Mr. FLETCHER, alluding to the best materials for the repair of footpaths, said that was a matter that must depend upon local circumstances. Where, as was the case in his county, they had plenty of gravel there was no difficulty on that head.

FRIDAY, APRIL 30.

SECTION A.

CONTROL AND MANAGEMENT OF MAIN ROADS BY
LOCAL BODIES.

CHAIRMAN :

SIR HENRY FAIRFAX-LUCY, BART.

SECRETARY :

H. STAFFORD GUSTARD.

TECHNICAL SECRETARY :

E. PURNELL HOOLEY.

Paper 3 was taken as read, as follows :

PAPER 3: BY F. H. BERRYMAN, CHAIRMAN OF THE HIGHWAYS
COMMITTEE OF THE SOMERSET COUNTY COUNCIL.

It is, perhaps, convenient to approach the consideration of control and management separately, taking under *control* the administrative body, the area in its charge, and the sources and conditions of its income ; under *management* the actual methods adopted for carrying out the statutory duties imposed.

By the Local Government Act, 1888, the control of main roads is vested in the County Council, and the whole cost of maintenance laid upon the general county account. This Act creates an important distinction between main roads in rural districts and those in urban districts which "claimed to retain" their main roads. In the latter case a peculiar undesirable situation exists, practically resulting in the Urban District Council being in a position to spend almost what they please upon their main roads (so long as any improvement executed is "connected with maintenance and repair,") and demand repayment from the County Council. The only remedy open to the latter is to refuse to pay, leaving the Urban District Council to apply to the Local Government Board to settle the matter. As, however, it is their practice to give no reasons and there is no appeal, it is submitted that such a position is obviously unsatisfactory and opposed to public policy.

To remedy this it appears desirable (1) to amend the statute by introducing a definition of the principles on which the annual contribution should be based; (2) to provide a means of arbitration in default of agreement, in which the arbitrator should assign reasons for and base his award upon precedent in order to obtain a clearly settled practice, with power of review by the High Court on appeal.

With regard to rural main road administration, if we take into consideration past experience, altered conditions of modern traffic, increased facilities for supervision, and economy resulting

from administration of the *largest* areas practicable, the undesirability of any reduction in existing administrative areas is clear. Consequently, we must either (a) continue the county unit, or (b) form new increased administrative areas, or (c) transfer the control and management of main roads to a central Government department.

To consider these separately.

(a). *Retaining the County Unit.*—An ideal local administrative body possesses many inherent advantages over any central authority, by reason of its knowledge of the locality and its requirements, and its prompt acquaintance with any changes therein. Again, the personal influence which can be brought to bear upon other authorities and individuals with whom such authority is brought in contact, is an asset of the highest value in promoting the smooth and efficient conduct of public affairs. Hence the desirability of retaining the “local” element in administration. At the same time various objections have to be met. Unfortunately, all local bodies cannot be considered “ideal,” and when administration is committed almost absolutely to them, their efficiency or otherwise must rest largely upon their *personnel*. As this is a varying quantity in every case, we risk losing that uniformity which is so essential in a work of such national importance as main road administration. Consequently, some bodies will always require “keeping up to the mark”; on the other hand, some may allow their zeal for “ideal” conditions to dominate their discretion. Others, again, may permit indifference or the falsest of economy to lessen the efficiency of their materials or their permanent staff.

Although no specific grant is made for highway purposes, yet the taxpayer does in fact contribute to road maintenance, since the balance of the Exchequer contribution is carried to the general county account, out of which these expenses are defrayed. He therefore appears clearly entitled to some means of ensuring that his money is expended to the best advantage.

It is submitted that these considerations show the absolute necessity for a central Government supervisory department, or, perhaps, a specialised branch of the Local Government Board, whose duty would be to inspect the main roads throughout the country and satisfy themselves (a) that those roads are maintained at a proper standard, and (b) that that standard is obtained by the most efficient and economical methods.

Again, it is generally conceded that the cost of main roads is not equitably apportioned, and that amendment of its present incidence is necessary. So long as any divisions of the total area exist, it is impossible to avoid special disabilities falling on certain authorities—such as heavy transport charges on all material, specially numerous and expensive bridges to maintain, or abnormally heavy traffic resulting from geographical position with regard to large county boroughs. No better means of counteracting these seem available than by grants from the national purse.

To make the relief in any way proportionate to the special disabilities of the recipients, it must be based upon the cost of maintenance rather than any mileage basis. It would, however, appear necessary to divide the present main roads into two classes—say, “trunk” and “county.” As an initial suggestion a grant of

60 per cent. of the approved cost of "trunk" and 40 per cent. of "county" roads does not seem unreasonable, but it is admitted that these figures are somewhat arbitrarily chosen. In formulating a detailed scheme it might be desirable and politic to regard part of the Exchequer contribution as allotted to highway maintenance. This could be computed by taking as allocated the same proportion of the total surplus transferred, as the main road expenditure bears to the total expenditure on general county account.

Since it appears that the chief defects in the existing system are capable of improvement by comparatively simple means, it is submitted that the county, aided by the purse and inspected on behalf of the Government, would form the most convenient and *experienced* unit for main road administration throughout the country.

(b). *Formation of New Administrative Areas.*—Amended areas cannot in themselves counteract the disabilities referred to. Will they simplify and reduce the cost of working? Since the county is the existing administrative unit for so many purposes, and possesses a financial and clerical staff available for highway administration, the formation of new areas for one specific purpose only appears likely neither to simplify nor reduce the cost of administration to any extent commensurate with the objections entailed. Great difficulty in obtaining an equitable financial basis would have to be faced. Doubtless the formation of extended areas, comprising county boroughs, would have advantages, but, considering the difficulties entailed, it certainly seems preferable to endeavour, in the first place, to attain the objects sought by comparatively simple amendments of existing methods than to risk the delay and confusion that must inevitably follow such a sweeping, expensive, and, as it may prove, unnecessary reconstruction.

(c). *Transfer to Central Department.*—Discussed elsewhere.

Generally, it is submitted that in the interests of the community all highway authorities require for efficient administration further and more definite powers—viz.: (1) to enforce laying hedges, cleansing ditches, lopping trees, etc.; (2) to acquire land for improvements, and easements for drainage, with cheap and simple means of fixing compensation therefor; (3) with respect to building lines, etc., such as are granted to urban authorities by by-laws.

The promotion of an adequate supply of well-trained, competent road engineers must not be overlooked. Special branches at the universities, with a diploma, should be considered; also a central pension scheme, irrespective of change of service among local authorities, with a compulsory age limit for retirement.

Provision also seems necessary of a means of revising, on equitable terms, without recourse to Parliament, powers granted to railway, canal, and similar companies, where circumstances have so changed as to call for modification thereof in the interests of the general public.

It is submitted that when trading companies, such as tramway or electric light, use the roads without payment, they should be made responsible for any *extra* cost thrown on the road authority thereby. At present the sympathies of the Board of Trade and the Light Railway Commissioners seem entirely against the ratepayers.

MANAGEMENT.

At the present time there are practically only two methods by which this is effected : (a) *direct*—i.e., County Councils employing their own labour and surveyors throughout ; (b) *indirect*—i.e., by contract with Rural District Councils.

Direct Management.—This method is undoubtedly gaining in popularity. In 1902 38 County Councils were returned as adopting this system, whereas the Local Government Board report 1907-1908 gives no less than 51 out of 61 County Councils (England and Wales) as so doing. The same report gives the average cost per mile as identical under both systems—viz., £69. "Average cost per mile" may not be an ideal means of comparison, but these figures undoubtedly tend to show that the charge, often brought against direct management, of being far more costly is not sustained.

Indirect Management.—Many of the objections which are—quite reasonably—brought against this method appear to arise from a fundamental misconception on the part of County Councils adopting it. They frequently seem to think that if the actual work be done by the Rural District Councils, the whole policy of *administration* must be left to them also. It is submitted that County Councils are entirely wrong in thus failing to perform duties placed upon them by the Legislature, with the obvious intention of obtaining the advantages of uniform administration over larger areas. To shelve their proper responsibilities, and content themselves with a mere perfunctory annual inspection, seems indefensible. The required funds for main road purposes are entrusted to the County Council. The county ratepayer is surely entitled to demand that the maintenance of *every* main road throughout the area towards which he contributes shall be the subject of a definite, efficient, and uniform policy, specified and assured by that authority into whose charge the necessary funds are paid. Much, however, can be said for joint action.

That the County Council should clearly define its policy throughout its area, and the detailed methods by which that policy is to be carried out, and then avail itself by contract of the services of the Rural District Council for carrying out the specified work, seems to afford opportunities of considerable mutual advantage.

To consider some more closely : 1. The extra work, together with establishment allowances, enable the Rural District Council (a) to employ a more skilled and better paid surveyor ; (b) to keep their staff more fully and profitably employed. 2. By arrangement the County Council can obtain the right to approve the appointment of district surveyors, and so insist upon properly qualified men. 3. The influence of the County Council can be used to check sub-contracting generally, and particularly with the lowest tenderer, irrespective of experience or capability. 4. The district surveyors can avail themselves generally of the advice and wider experience of the county surveyor. 5. The County Council, by insisting on specified requirements, can check any undue predilection for the low-priced but extravagant local material, or tendency to confuse highway and poor-law administration. These points should react favourably upon the district roads and produce an improved standard throughout. 6. The

County Council obtains work carried out under conditions tending to economy, avoids overlapping, and obtains the advantage of the personal interest of the Rural District Council in the work. These considerations, it is submitted, show good ground for stating that joint action in management possesses 'potential' advantages for both parties, provided each loyally performs its share.

Finally, for efficient administration, in whatever hands it rests, this must be borne in mind :

That the work entrusted to public authorities is so wide that the "director," who may be chosen for a variety of reasons *other* than acquaintance with the work before them, cannot hope to bring specialised knowledge of every branch to their task. Thus they are largely dependent upon their technical advisers for submitting to them the most efficient and economical methods. Moreover, the actual detailed work rests upon the permanent staff. It is, therefore, clear that for *satisfactory administration a competent, experienced, and loyal staff is essential*. No falser economy or surer source of failure seems possible than attempting to carry on any undertaking with an inefficient or discontented staff.

In every undertaking the human element is the source of action, and to work any complex organisation to the best advantage it is necessary to provide effectual supervision throughout.

It is submitted that by the suggestions outlined above, a complete chain of supervision would obtain, from the roadman on the highway to the chief of the central department, who would be responsible, through Parliament, to the nation.

DISCUSSION.

Mr. HUTCHINS (Montgomery) said that Mr. Berryman's paper covered the greater part of the ground he had intended to cover, and looking at that fact he would not occupy the time of the Conference very long. The whole difficulty was not so much one of control as of finance, and the only feasible way out of it was State control and State subsidy to a considerable extent. Of course, that meant the classification of all roads. Many of the district highways, as regarded the traffic they brought on to the main roads, were like main roads themselves, so that there would have to be a re-classification; and his suggestion was that the whole of the roads should be taken under the control of the State, and financed according to their importance. The great trunk roads would come first, then there would be a second class, with the highways last of all. The State should pay at least half of the expenses in connection with them, and in consideration of that should have the control of the whole of the roads of the county. This, of course, would necessitate the formation of a State department. Having control they would be able to standardise the manner in which the roads should be kept, and it was

conceivable that some of them might be kept up to a better standard than they were at present. The difficulty of the present system was proved in the case of the smaller counties in relation, say, to tar. It was known that the surface of the road when properly tarred lasted much longer than when it was not tarred. His roads had cost £20, and this year they cost £30. To tar them all over would involve another £40, and the ratepayers were not prepared to pay the money. As to the details of State maintenance, he would suggest that things should remain practically the same as at present, but that while the highway authorities repaired the roads the Government should send down an inspector to see that the work was maintained at the necessary standard.

Mr. C. T. LANE observed that his views were not entirely in accord with those of the last speaker. The necessity for some scheme of equalisation of rates was all the more pressing from the extended use of the facilities of intercommunication between one part of a county and another; but how this was to be done was a rather difficult question, as the local conditions varied so much all over England. Material was sometimes available and sometimes not, and the distances they had to be brought involved financial considerations. In the Budget introduced into the House of Commons on the previous night by the Chancellor of the Exchequer they had the idea of establishing State control over the roads, and this would undoubtedly help to elucidate many of their difficulties. He did not know whether the members of the Conference had read the report of the Governmental Commission with regard to the roads, but he might state that this divided England into areas, and control of the roads was suggested in that way. That might be used as a sort of nucleus by the Government, and no doubt the scheme would be developed in the future. As to the State standing on one side from the local authorities, that could not be allowed.

The CHAIRMAN: Would you explain what you mean by State control? It is rather a loose term.

Mr. LANE: Under the control of the State they generally had to bow to what they said. His idea was that the State should control the whole of the roads, but that for local administration these should be divided into various areas.

Mr. FERARD (Berks) said he appreciated the difficulties, to which the author called attention, as regarded the disinclination of the Local Government Board to give reasons for their decisions in cases of arbitration, but he thought that if people had been willing to go to arbitration more frequently that difficulty would soon have been cured. He did not look upon arbitration as involving an acute difference between parties, but as a means of settling comparatively small points. As to the proposal to have an appeal from the arbitrator to the High Court, he did not agree that there should be any such appeal on questions of fact. There should be some point of finality, and on the question of fact

they should be satisfied with the decision of the arbitrator. He had no hesitation in expressing an opinion in favour of direct control. In Berkshire they had gone in for direct management, and had never regretted that step. As to the question of the contribution by the State, he confessed that that involved a difficulty. He was surprised to find from the Berkshire county accounts that 50 per cent. of the different county services received contributions from the Imperial funds. But what price were they going to pay for any further contributions. It would mean a surrender of the counties in higher administration. Why should they have central administration? Was it in order to provide more efficient officers? He was quite prepared to say that the Government was not going to provide them with more efficient officials than they had at the present time. Was it to obtain more efficient repair and management of the roads? No. They wanted the central authority because they wanted more money. The Government would send down some ex-officer of the sappers, or some other official of the same kind, to whom the local authorities would have to surrender their independence. As to classification, in nine cases out of ten main roads were never classified on any scientific principle. By the Act of 1885 it was sought to do financial justice to the various parts of the county, but the result was the muddle of the main roads, as to many of which it was difficult to see why they should be main roads. This was a matter that would have to be settled by an independent expert or commissioner, as it could not be done by an officer of the State.

Colonel DENISON (Northampton) endorsed what the last speaker had said with respect to the control of the roads. A short time ago it was the policy of the State to decentralise, to make District and County Councils. Now it seemed they were going to stop that, and centralise again, and he felt sure such a policy would be prejudicial to the management of the roads by various counties. They heard complaints that some roads were not managed so well as they should be, and it appeared to him the remedy was to show the counties what the best system of management was, and level those that were not up to the proper level up to the level of those that were. All of which meant that they should make the roads efficient, and much of the same quality throughout the country. State control would discourage the counties, for they would be bound hand and foot by the inspectors sent down to them. They ought to fight against that, for he was certain they would suffer very much, while it would enormously increase the cost of the roads.

Mr. GULLAN (Belfast) agreed with the last speaker with respect to the classification of the various roads, and it seemed to him that the time had come when the county authority should be the authority for the control of the roads. The question raised of State control seemed to have assumed the aspect that it must mean State management. There were

certain features of State control which had advantages, and it might be possible to draw up a scheme to meet the present requirements of modern highways and give the advantages of central control without the disadvantage of the red-tapeism that naturally gathered around State control. They had a great object-lesson as to State control in France. The roads there were in anything but the condition they had been told to believe they were in. The conditions applicable to the roads had changed within the past few years, but they found in France that the old state of things was still going on, and this was undoubtedly due to the red-tape of State control. The effect of this was that while there existed a very efficient school dealing with the cost and quality of materials, and the standardisation of roads, they were not able to apply their information. He would, therefore, suggest that State control should not of necessity also mean State management. A central authority should be organised, to be known as the Central Highway Bureau, which would be a representative body—that was to say, the various authorities should have the power of representation thereon as well as the Government. Having got such a body, he suggested that its duties should include the collection, arrangement, and dissemination of particulars and statistics with respect to the management and control of highways. This bureau would embody the eyes and brains of the various authorities throughout the country that were largely and successfully endeavouring to cope with existing conditions, and the conditions that would arise during the coming centuries. There should be prepared a standardisation return collected and collated under the authority of the Board, and this should be disseminated throughout the country authorities, who would be in direct connection with the central authority. Then there was the question of State subsidies which was forced upon their attention by what took place in the House of Commons the previous night. This Board having been formed would be the best authority for equitably allocating the grants to be made without the disadvantage of having some ex-sapper, as had been suggested, or other person of that sort, put in charge as the controller of affairs on the part of the Government. The bureau would, he repeated, represent the local authorities and the Government as well. He put forward these suggestions feeling confident there was a possibility of arranging for a central authority that would have the advantage without the disadvantages of State control.

Mr. PURSER (Kesteven) was sorry to find surveyors encouraging State control. The only State control they wanted was State contributions, and as they had a body created to represent the local authorities in the County Councils Association he thought the distribution of the money might be fairly well left to them. They needed somebody better than a retired sapper or major-general to manage these things from London. During his visit to Paris he had many opportunities of

motoring round the city, and if they compared the setting and laying-out of the roads, for which the French local engineers were not responsible, there undoubtedly the French system beat the English. But when they considered the surface state of the roads, for which engineers should be praised or blamed, there he thought the English were far ahead of the French. Many of the roads they passed over had such a high centre that from the English point of view they would be considered highly dangerous. They saw some roads $1\frac{1}{2}$ in., if not 2 in., to 1 ft. cross-fall. As regarded direct management and indirect management through the Rural District Council, there was something to be said from both points of view; but it seemed to him that if the County Councils handed over their responsibility to others, and ceased to have anything to do with the management of the roads except pay, they misconceived their duty. In his case the County Council made an arrangement with the Rural District Councils. Each road was scheduled, and each section which it was proposed to treat during the year was specified, and it was the duty of the county surveyor to see that the District Councils carried out the contract. As far as his experience went, there was no difficulty in getting them to do that; indeed, he considered that the Rural District Councils treated the central authority with absolute fairness. The great advantage of such an arrangement was that the rural district surveyors were on the spot, and the quality and quantity of the material could be agreed upon, leaving the final word to the County Council surveyor in case of disagreement, and thus they had the advantages of direct control joined with local influence, with reports given by the surveyor of the Rural District Council.

Mr. WOOD HOMER (Central Chamber of Agriculture) said the Local Taxation Committee of the Central Chamber of Agriculture looked with great concern on the enormously increasing cost of the roads. In Dorset 19 years ago the cost of the county roads was £25,000; now it was £52,000 a year. Up to the time they spent £25,000 they received a moiety by way of grant from the Government, but if since then they had received half of the increased cost the ratepayers would have been £84,000 in pocket. The Government was not paying anything like the proper proportion of the cost of the main roads of the country. He quite agreed that the roads should be standardised, and he considered that the whole cost of the main trunk roads should be paid by the Government. The latter might contract with the County Councils to do the work, but it ought to virtually pay the whole of the cost of a work that was not of a local but national character. They had heard a good deal about Government control. In his humble opinion, the local authorities were already controlled too much. If they appointed local authorities to manage things and gave them the power, they should be as little controlled as possible. He agreed that the central body might with advantage under-

take the roads, and see that they were kept up to standards 1, 2, and 3. He would suggest that the cost of standard No. 1 should be entirely paid by the Government, standard No. 2 half paid by the Government, and standard No. 3 by the local authorities. It would be of the greatest benefit if, as the result of that Conference, they could formulate some representative opinion on this important subject, and he would suggest that a resolution be submitted to the representatives, because he could not help thinking they might thereby have some influence upon the Government as to the future management of the roads.

Mr. FOX ALLIN (Smethwick) did not think it was possible for the country roads to be maintained in a better manner or in better order than they were to-day. On all hands he had seen a great improvement in the condition of the roads since the County Councils were called into existence. They were better made, and better supervised. Of course, there were sometimes difficulties, as when large urban districts maintained their roads and had half the cost refunded by the County Councils. Where there was a town of 80,000 or 90,000 population the main roads had to be treated very differently, and when the settlement of accounts came along there were frequently differences to be considered, but these could be adjusted by the county and urban surveyors.

Mr. DAWSON (Bradford) rose for the purpose of submitting objections both to State control and the cumbersome Board which Mr. Gullan had suggested. He did not know yet what was wrong to justify these proposed changes. They knew that in 20 years a great improvement had taken place in the condition of the roads of the country; and as to State control, if what some of them saw in Paris was the result of State control, they did not want any such control in this country. State control was cumbersome, troublesome to work, and unsuccessful. Besides, it would be passing a vote of censure upon themselves and their own management to invite it, and they had quite enough to meet without doing that. They had swine fever in his district, and the official who was sent down about it was "a ruler of the King's navee"—he was a naval captain. He strongly supported the arguments advanced by previous speakers against any control beyond the control which took the form of suggestions for improving things.

Mr. MONCUR (Staffordshire) observed that he quite agreed with the existing arrangements for arbitrating by the Local Government Board. If they could get the Local Government to give reasons for their decisions they would be all more than delighted, but he was afraid that would not help them much. For, as a matter of fact, there were urban roads and urban roads, and expenditure and expenditure. Since 1890 the urban authorities in Staffordshire had received the full grant they had spent on the roads. There were urban districts with large populations, with streets from end to end, where there was a great deal of watering and scavenging done, and which

was required from the sanitary point of view, but unnecessary from the point of view of maintenance. In these cases it was only reasonable that the County Council should be called upon to pay that which was due for maintenance only. As to State control, he must say that in Staffordshire they were strong "home rulers." They did not believe in any interference whatever, and he was disposed to think that his committee, as a committee, would rather have no grant they might be voted by the Government if the condition laid down was that the work was to be supervised. It seemed to him it would be impossible for a Board in London to know all the requirements, difficulties, and necessities of the maintenance and repair of roads throughout England. It was only the man on the spot who knew all the difficulties he had to contend with. If they once agreed to Government control, this was what would happen. If the Board should send down a representative to Staffordshire on a particularly fine day he might feel happy. In Shropshire, on the other hand, he might be sent down on a bad day. In the circumstances he should be sorry for the surveyor of Shropshire, for it was a fact that roads changed not only according to the condition of the traffic, but also owing to the atmospheric conditions prevailing. If a grant was to be made to County Councils, or any road authority, the inspection must be regular throughout the year, and he did not see how that was possible. He held up both hands in favour of State aid, but he hesitated to hold up one in favour of State control.

Mr. HOOLEY (Notts) protested against the slurring references to the "sapper" and other officials. His chairman was an officer, and nobody could work with a gentleman more qualified to guide and advise than he was. There were, of course, engineers and engineers, and he hoped that if the Government did see fit to make a grant, and an engineer would not acquiesce, there was no possibility of a captain of the navy being maintained in his post merely to find fault with the condition of the roads. He (the speaker) thought they should wait till they had something to object to before they started objecting. The Government gave them help, and now they were quarrelling about what they had been asking for so long. He had seen what semi-control in South Wales meant, and had never found it irksome, and he did not think they as county surveyors need fear that if the Government gave help they would have much to complain about. He objected to the proposition that because they knew what was best for their own county, therefore they knew what was best for all England. They were making a rod for their own backs in taking up such an attitude.

Mr. BERRYMAN, in reply, said there was one apparent misconception that had found its way into the minds of many speakers, and that was that an attack was intended on the County Councils. As a matter of fact he wrote almost

exclusively from the County Councils' point of view, and there was no suggestion in his mind that these Councils failed, as a general rule, to carry out their duties in the most satisfactory manner. But he thought they were rather inclined to consider the matter from one side only. They were there as representatives of road administrators, and it seemed to him they had looked at the matter too much from their own point of view. They would better approach a consideration of their responsibilities if they viewed the matter more generally as it appeared to and affected the interests of the community. He could not give a better example of this attitude he alluded to than by quoting Mr. Homer, who said, "So far as expense is concerned, let it be paid by the central authority, but as to supervision, I will have none of it."

Mr. HOMER: My remarks applied to the second class of roads.

Mr. BERRYMAN: But you suggested that the second class should be paid for. They must look at the matter (continued the speaker) not from the point of view of the individual, but from the point of view of the community, who were going to provide the money. As to State control, generally speaking, he suggested that the trend of the debate had been to consider the advisability of State management. Personally, he strongly condemned State control, but he did not know that State management was to be dealt with, and on that account he did not propose to reply to the criticisms on State management. His suggestion was in the direction of a supervising body, such as existed with respect to the police and education. Either they must forego their grant, or else they must submit to some reasonable inspection by the central authority. The speaker from Berkshire said he objected to an appeal to the High Court on questions of fact. Any such proposition was not in his (the speaker's) mind; the appeal he thought of was on questions of law and evidence, not of fact.

The CHAIRMAN: Would that add to the expenses very much?

Mr. BERRYMAN: Yes, it would in the first place, but, at all events, it would provide a settled practice, and, in ordinary parlance, they would know where they were. He was surprised to find objection raised to the personnel of the suggested authority. It seemed to be thought that an authority of that description must be a law unto itself, and not be guided by practical experience, refusing to act on practical lines or work for the general advantage. He was still more surprised that such a line should be taken, because such a central authority, if not comprised of, should have, at any rate, a large representation from the expert talent of the profession. He should like, finally, to put in a word on the question of the desirability and importance of the central authority collecting and disseminating statistics and information, and also in obtaining throughout the country, as far as might be, a uniform standard. It was clear to anyone

acquainted with the whole area of the country that a totally different standard was maintained in one district to what existed in another. He heard a gentleman say on the previous day, "We want larger grants because of the national traffic that pervades our district; we maintain our roads in every way sufficient for local requirements." It seemed to him (the speaker) that that was a very contradictory position to take up.

CONTROL AND MANAGEMENT OF HIGHWAYS NOT MAIN ROADS.

PAPER 4: BY ARTHUR GLADWELL, ENGINEER AND SURVEYOR
TO THE ETON RURAL DISTRICT COUNCIL.

The question of the administration of the enormous mileage of ordinary highways in this country is one of some complexity, owing, among other things, to the present chaotic state of highway law, and more especially to the unsatisfactory character of many of the provisions of the Local Government Acts of 1888 and 1894.

In the author's opinion, among the pressing needs in connection with the subject of highway administration is the question of a complete, effective, and comprehensive classification of all roads on the basis of the traffic they are called upon to sustain, as well as an intelligent standardisation of methods of maintenance and repair of all classes of roads, and until such classification and standardisation is undertaken as a preliminary to fresh legislation, little good in the direction of more efficient highway administration will be accomplished.

Were such classification an accomplished fact, it would at once clearly demonstrate that there are in this country hundreds of miles of so-called main roads which never were, and probably never will be, "main" roads, judged from the standpoint of the ordinary English meaning of the words.

The present most unsatisfactory state of the law which enables County Councils to interfere with the functions of other local authorities, requires amendment in the direction of preventing the indiscriminate, and, in many instances, illegal declaration of relatively unimportant roads as main roads, which some counties have indulged in.

This view is supported by one of the recommendations of the Royal Commission on Local Taxation, 1901, which reads as follows: "We fully recognise the fact that the changes in locomotion which have taken place during the last quarter of a century, and the different policies which have prevailed in different counties as to maining and dismaining roads . . . have rendered it eminently desirable that some authoritative and impartial body should revise the distribution of the main road grant, and decide what roads should be main roads alike in counties, and county and quarter sessions boroughs. . . ."

It will be generally conceded that the duties imposed on County Councils are so increasingly extensive and varied as to

claim the almost undivided attention of county representatives, and it is quite certain that the imposition of additional duties cannot be indefinitely extended. It would, therefore, appear desirable that the powers of local authorities other than County Councils in connection with the administration of highways other than main roads could be very usefully extended. It may be argued that many of the smaller local authorities have not risen to a sense of the importance of their duties and responsibilities, but, generally speaking, the manner in which the duty of local self-government has been carried out by the large majority of urban and rural authorities is not open to the above criticism.

In this connection it cannot be successfully argued that Urban and Rural Councils are in an inferior position as compared with County Councils in the matter of the supply of either materials or labour; the market is a perfectly open one, and the smaller authorities can purchase just as intelligently and economically as the larger ones, and can also command the services of quite as competent officials if they will but offer a reasonable and honest scale of remuneration.

It is the "authoritative and impartial body" mentioned in the report of the "Local Taxation Commission of 1901" which is now required, and should, the author considers, take the form of a "Roads Commission," which should have the power of supervising the highway work of all local authorities alike, and which would decide all questions relating to highways and the allocation of Imperial Exchequer contributions. These should be given not only to county, but to all other road authorities whose roads were properly maintained.

Once the question of the status of the various classes of roads was settled by means of a proper classification, and the functions of local authorities were properly and clearly defined by legislation, it would be a comparatively simple matter to devise methods of administration applicable to the altered conditions.

Assuming that some such administrative machinery for the supreme control of highway administration as that sketched above were in operation, it would have the effect of improving the status of the smaller authorities, who would be found quite as competent to carry out the duties imposed upon them as County Councils have hitherto proved themselves.

If Urban and Rural Councils (together with all other road authorities) were made directly responsible to one supreme authority, it would inevitably bring about a considerable improvement in the condition of the roads of the country, without any appreciable increase in cost.

Under such a system, not only would it be possible to determine what was the correct status of each road, whether a trunk or national road, an ordinary main road, a district highway of the first, second, third, or fourth class, etc.; but the question of the standardisation of methods of repair and maintenance of the various classes of roads could be very largely determined, and the present chaotic condition, both of administration and practice, so ineffective and costly, would soon be only a memory.

Were the urban and rural authorities placed (in respect of their highway duties) on the same footing as other authorities, under the control of a Government department, the question of administrative detail would also very speedily be adjusted; the relatively

unimportant urban and rural districts could be joined to adjacent districts, and be administered by joint committees, just as is now done in the case of sewerage or sewage disposal and hospital work.

A great deal has been said and written, especially on behalf of the votaries of the more modern form of road locomotion, in favour of centralising highway administration. Viewed in the abstract, this may be an attractive theory, but so long as the ordinary ratepayer has to pay by far the greater share of highway expenditure, so long will the ordinary ratepayer claim to have a voice in the spending of the money.

The fact will have to be faced that, after all, it is the ordinary ratepayer who will have to be consulted in this matter, and not the advocates of centralisation of authority and control, whose motives appear to the ordinary observer to savour too much of immediate self-interest and too little of the greatest good for the greatest number to merit very serious consideration.

The general proposition sought to be advanced by the author is that, having regard to the great increase of traffic which all the roads in the country will have to sustain in an increasing measure as the years go on, and having regard to the fact that County Councils are already overburdened with duties, the time has arrived when the services of other authorities can be usefully and economically employed, and more especially so in connection with the management and control of highways.

The boldest advocate of centralisation of control in highway administration cannot successfully argue that the entire intelligence or skill required for the administration and control of highways is centred in County Councils and their officials; the latter can quite appropriately be left to control main roads, but it would be a grave mistake to place any further task on shoulders already well (if not over) loaded, inasmuch as centralisation of control in this connection would inevitably be followed by decentralisation of administration, and result in the maximum of taxation accompanied by the minimum of representation.

PAPER 5: BY J. FRED. HAWKINS, COUNTY SURVEYOR OF BERKSHIRE.

Since the passing of the Motorcar Act in 1903, one of the leading questions of the day has been that of coping with the increasing traffic. In those counties in which the increase has been most rapid the roads are maintained under various systems of control—some systems being a great deal more practical than others. In England and Wales the roads outside urban areas are divided into two sections—main and district. The main roads are under the jurisdiction of the County Councils, the district roads under that of the District Councils.

When the Local Government Act, 1888, first came into operation, the County Council took over certain roads, choosing those main arteries of communication which were in general use at the time, some counties taking over many more miles of road than others. The County Councils of Hertfordshire, Norfolk, and Gloucestershire were the only councils which took over a very large percentage of the whole of the roads in their respective

counties. Under the Local Government Act, 1894, the remainder of the roads came under District Councils. In Ireland the roads are managed in a very similar manner. Scotland had a comparatively recent Roads and Bridges Act, passed in 1878, and almost all the roads outside urban areas are under County Council management.

France has an entirely different system of control. There the roads are under State control, managed by the Department of Ponts et Chaussées, under the Department of Public Works, and the main trunk roads are paid for entirely by the State. Swiss roads are under cantonal jurisdiction, and, though under no central department, receive a grant from Government for the main inter-cantonal arteries. In parts of Germany the roads are under State departments, and in parts under provincial authorities, but in all cases receive support from the Government. In Australia the roads were at one time under a central authority, but latterly have been decentralised, and are now managed by large local authorities, receiving grants from the various States.

There are many defects in our English system of road management, one of the greatest being that we are still in the main governed by the old Highways Act of 1835, which was passed to meet circumstances differing widely from those of the present day. A further weakness in our system lies in the number of different authorities having control over the roads within the same area, with the result that there is no uniformity of standard. At the present time there are 62 County Councils and 655 Rural District Councils in England and Wales. The County Councils are, to a certain extent, at one on the principle of maintenance, agreeing that sound construction, limited only by the funds available, is the only correct method of coping with the increasing traffic. In the absence, however, of direct financial aid from Government, the standard of efficiency necessarily varies with the financial ability of each county. In the case of District Councils, on the other hand, with for the most part small areas, and the consequent subjection to local pressure in the direction of economy, without due regard to durability, the variation of standard is very great, and, as a rule, the standard of efficiency is very low. Looking through reports of District Council meetings one sees continual complaints of the bad state of the roads, owing to ill-directed economy in maintenance, increasing traffic, or other causes. Yet, when estimates are presented, the small local authority, knowing that no grant will be forfeited, reduces the highway estimate to the lowest possible sum required for the minimum needs of the traffic.

The average District Council does not yet seem to have grasped the fact that good material is carted as cheaply as bad, and that properly applied, the former lasts years longer than the latter. Some District Councils have steam-rollers and do good work with them, but there is a great majority of councils which have no rollers. Then, again, one often sees on district roads hired rollers weighing 15 tons, which do the work quicker than a 10 or 12 ton one would; but, given cheap material, poor foundations, and such heavy rollers, the stone is naturally crushed to powder at once, and vast quantities are practically wasted.

Another mistake made by some District Councils is that of

letting out the roadwork by contract. Small lengths are handed over to men who do the work at the lowest possible cost, and who naturally make what little profit they can for themselves. The district surveyor, in many cases being himself very badly paid, is almost compelled to pass the work to save extra journeys and travelling expenses, which have to come out of his very meagre salary. I have personal experience of the work and worries of district surveyors, and in many instances I can fully sympathise with them; but their troubles do not end here, for, in hundreds of cases, the roadman on a district road is given work as a form of "out-door relief." He is often a man who, having worked hard all his life, brought up a large family on a small wage, is, when applying for help in his old age, given a job on the roads! In the past this may have been pleasant and peaceful work, but in our days it must be far from pleasant, and one cannot expect an old man to cope with the work which is absolutely necessary to keep the road in anything like repair. The few young and strong men one finds on district roads are usually taken off for harvest work, thus providing the landowners with the men who, in many cases, are so difficult to find. This is not the economical arrangement it appears to casual ratepayers, but is a very short-sighted policy, since it deprives the roads of that continual attention which is so necessary to prevent them from breaking up in dry weather. I have mentioned a few of the difficulties with which efficient surveyors working under District Councils have to contend. I must own, however, that in many cases the so-called district surveyor is himself at fault. I have known farmers, bailiffs, steam-roller drivers, builders, and even one gasfitter and one publican who have held posts as "district surveyors." Practically all these weaknesses could be rectified if the governing body were a larger and more powerful one. In speaking in this sweeping manner of District Council management, I do not wish to imply that all district councillors consider economy and personal interests before efficiency. I know of a large number of councillors and many chairmen of District Councils who have for years fought hard to improve the roads within their jurisdiction, and had it not been for their work and perseverance, the district roads would be in an even worse state than they are now.

The Scotch system has many points in its favour. The County Councils being large authorities are strong enough to deal with all matters without fear or favour. There must be considerable saving in the expenses of administration as compared to those in England and Wales; the materials, being bought in large quantities, are cheaper, and the carting of them less expensive; the surveyors' work does not overlap, and labour is more concentrated. The French system of control is an altogether different one, and we have much to learn from it. The whole management is under one central authority, and the work is dealt with by competent officials under a Government department. The roads are classified under several headings, and the expenditure is distributed according to their various needs. The surveyors are trained men, and even the men working on the roads must have a certain knowledge of road construction. The Routes Nationales are very fine, but it is admitted that the other roads are kept up at a very small cost, have poor foundations, and the bridges in many

cases are not safe for heavy traffic. The maintenance of the roads is carried out by contract, this being the system which at one time was practised by the Kent County Council, and which was abolished by them a few years ago, with every justification. This system on a large continent may be the best, but on our small island it is important that the roads as a whole should be kept up to a reasonable standard of efficiency, it being almost impossible to draw a definite line between "Routes Nationales" and others, as even our secondary roads carry a great deal of heavy traffic. It may be observed that the French have not nearly the amount of traffic which we have to deal with in England, and, even as it is, the necessary repair is over-taxing the financial administration.

The roads in England and Wales which were brought under "direct control" of the County Councils after the 1888 Act, particularly in the three counties I have already mentioned—Hertfordshire, Gloucestershire, and Norfolk—are far better than those roads which were let out on the contract system, or were handed over to the District Councils to be maintained by them, under the supervision of a County Council official, and the same can be said of those in Scotland, where practically all the roads are under County Councils. There are, however, in England, hundreds of miles of roads other than main roads which are managed by District Councils, and which are in many cases more important arteries of communication than some of the main roads. Under Section 11, Sub-Section 10, of the Local Government Act, 1888, the County Councils may, if they think fit, contribute towards the expenses of any district roads, footpaths, etc., but only in very exceptional cases would one feel justified in advising a Council to take advantage of this clause; because, from the very nature and extent of their business, the county officials are able to make the best of opportunities, of which the district surveyors, under smaller authorities, cannot take advantage.

After carefully studying the various systems, I may briefly summarise my conclusions thus:

1. All the roads outside urban areas should be under the jurisdiction of the County Councils for reasons already given.

2. Roads should be classified, a standard of efficiency being made for each class of road according to the probable amount of traffic—say (a) trunk roads, main lines of communication; (b) main roads, connecting these trunk roads; and (c) secondary roads, connecting villages and small towns, being for the most part used by local traffic.

3. As to finance, trunk and main roads should receive a grant from Government, and the secondary roads be wholly paid for by the County Council.

The police and education authorities, which deal more or less with purely local affairs, are allowed a grant on the recommendation of a Government inspector. The road authorities, on the other hand, provide, or are expected to provide, roads capable of carrying an enormous amount of through as well as local traffic, receive no direct grant from Government, and have to pay for them out of the local rates. This policy seems hardly a fair one under existing circumstances.

DISCUSSION.

Mr. CHAPMAN (Somerset) said a large proportion of the main roads were turnpike roads which the County Councils were compelled to take over under the Act of 1888. County Councils were very chary about maining roads. The Lancashire County Council would only main roads between large towns having a population of over 20,000. Also, they would not main a road parallel with an existing road between two towns or between a large town and an important railway station. The Somerset County Council were very chary about maining roads, more particularly in urban districts. Personally, he thought a great many of the existing main roads might be dismained, and, perhaps, subsidised, which would tend to efficiency. In Somerset no subsidy exceeded a moiety of the total cost, and separate accounts were kept of all subsidised roads; reasons being given why subsidies were withheld or withdrawn. He thought some similar conditions with modifications might be applied to trunk roads, provided they were subsidised by Government.

The CHAIRMAN requested speakers to direct their remarks to the consolidation of the highway law, which they were anxious to have a resolution on.

Mr. HUTCHINS (Montgomery) remarked that they need not expect to obtain the reforms indicated by Mr. Hawkins at the conclusion of his paper at a very early date, as all such changes were in the first instance bitterly opposed. He (the speaker) was charmed to hear the statements and arguments against State management, for they showed that great interest was taken in the matter; but what had charmed him more was that he had not heard a single solid argument against what was called State control, and the State supervision of roads subsidised by the Government. County independence was a very excellent thing, but it had sometimes an axe to grind. It was quite certain they would not get the State money unless they also got supervision by some Government official. He would remind them of the old proverb, "That he who paid the piper called the tune."

Mr. HORTON (Derbyshire) said Mr. Gladwell spoke of counties which for various reasons had increased the mileage of their main roads. The mileage in Bedfordshire had been largely increased, and so he believed it had in Buckingham; and when the increase took place in Hertfordshire some of the work passed through his hands. There was great disparity between the different areas of the county. In some districts the rate was 5d. to 6d., and in another the rate was as high as 1s. 6d., due to the disadvantage at which it was placed with respect to the supply of material. The Council felt there was an injustice in this, and they sought to remedy it, but never could do so. Therefore the principal highways in the county

were declared to be main roads, and for a period of more than 10 years they had been directly maintained by the County Council staff. The result was uniformity of rating, which was a great advantage to the county as a whole, and was much appreciated. At the same time there had been a most distinct improvement in the condition of the roads, and this, he thought, would be admitted by everybody who knew them. It had been suggested that the advantageous position held by the rural district surveyors was that they were on the spot, but surely County Councils were also on the spot and in charge. He ventured to say that the salaries paid to the district main road surveyors, though in many cases not so high as they should be, were better than the salaries paid by Rural District Councils, and as a result better men were obtained and better results ensued. In Hertfordshire they divided the main roads into first and second class, the standard of maintenance being higher on the former, and this had resulted in the roads being vastly improved and the grievance with respect to the incidence of taxation being remedied, the ratepayers obtaining the best possible value for their money. Every electoral division was interested in the matter by means of direct representation. Mr. Hawkins had referred to the danger of the small authority taking a limited view of their responsibility, and endeavouring to keep down the rate more than was necessary. Everybody who worked for a public body knew the tendency there was in that direction, and naturally the tendency was greater in small areas than in large. Therefore he did not think Mr. Gladwell's arguments tended to the adoption of the best system for improving the highways, though he would naturally resent any interference with the existing officers and their duties. In his opinion the best possible means of maintaining the chief of the district roads would be to transfer them to the County Councils. The officials would thus be working under new conditions, and the result, he felt assured, would be an increase of efficiency and true economy.

Mr. HOOLEY was very pleased to be able to thank both Mr. Gladwell and Mr. Hawkins for their papers. The text he (the speaker) would like the Conference to give their attention to was the chaotic state of the highway law. As an instance he alluded to a piece of turf in front of the church in a small village in Notts which belonged to the village. The Parish Council thought it would be a great improvement that the old fence should be pulled down and replaced by a permanent one, and they appealed to the County Council to ask them to allow the enclosure to take place. The Council, adopting as they thought, a common-sense view of the matter, resolved to take no notice of the enclosure, but it was proved that this body had no power with respect to this matter on their own main road, the legal position being that the District Council were successors to the surveyor of highways, and the County Council were not. He would like Mr. Gladwell in his reply

to state what was the illegal way of declaring any important road to be a main road. He always understood that the duty was cast upon the County Council, and how they could commit an illegality in using their own judgment he could not understand. The Act of Parliament gave general instructions as to what should be a main road, but it did not say that any other road should not be declared a main road. He (the speaker) thought the County Councils were perfectly justified in declaring the whole of the roads main roads. He appealed to the Conference to affirm that the time had come when they thought there should be a general reconsideration, reorganisation, and co-ordination of the highway laws.

Mr. PAYNE (clerk to the Edmonton District Council) observed that in his district a certain portion of a cross-road leading from the main London road to Hertford was maintained in consequence of the road leading to the railway station. The County Council did this on the application of the District Council.

Mr. GOWAN (Rural District Councils Association) was absolutely opposed to interference with the maintenance and control of district roads. Of course, they would say he was naturally opposed to interference, but he was opposed, not from inclination merely, but from conviction. Mr. Hawkins took up an indefensible position when he took away control from the rural districts and left it in the hands of Urban District Councils. Did he suggest that a little urban district of 2,000 population was better able to maintain the roads than, say, the district he represented—Croydon? If he did, he (the speaker) must say he did not think he could prove that proposition. At Croydon they had 130 miles of district roads which were maintained in a high state at an economical cost (10d.). In many urban districts the cost would be far more, and there was no evidence that the roads would be better maintained by the County Councils. He agreed as to the necessity for the codification of the highway law, which was in a decidedly chaotic state at present. The rural districts were in a difficult position with respect to tar paving. The County Council called upon the Rural Council to contribute a share of the cost of tar paving, and unless the Rural District Council was under contract with the County Council as to maintenance they found it absolutely impossible to make any contribution.

The CHAIRMAN: The main roads are maintained by the County Council.

Mr. GOWAN: Yes. It was highly desirable that the tar paving should be done, but in the absence of a contribution it was abandoned.

Mr. GIBBONS (Gloucestershire County Council) remarked that Mr. Hawkins had said a good many hard things about the District Councils. He had been on the Highways Committee of the Gloucester County Council, and a large

proportion of the members were in favour of making one road for the whole county ; but they had changed their opinion, because the District Councils were taking up the administration of the roads with so much zeal, and doing the work with so much efficiency, that it was considered they were quite as good as the County Council. People who were doing their duty did not like to be abused, and he was glad to say a word for those who were trying to do their duty. As to the suggestion that the District Councils employed old men, he thought that was dying out. The District Councils were, in fact, trying to produce as good roads as the County Council, and he thought the improvement would go on. It would be a mistake to remove the popular control and the popular interest of members of District Councils in the administration of their roads, and he hoped these Councils would be allowed to remain where they were.

Mr. FERARD (Berks) said the papers raised an issue between the County Councils and the other local authorities. Mr. Gladwell wished the District Councils to take a more important place in the administration of the highways, and Mr. Hawkins wished that the County Councils should undertake the whole administration. As to Mr. Hawkins, he had the fact to support him that there seemed to be an idea that more roads should be made main roads. That would lead to the expenditure of a great deal of time and trouble on the roads by the district authority. On the other hand, Mr. Gladwell thought that the local authorities ought to have more to do. He was chairman of a District Council, and in his opinion the difference between the local authorities and the County Council was that the County Council was able to take a wider view of their functions, as their area was so much more extensive, and they were free from local pressure, and—this being most important of all—could take up an independent position. Their roads were going to cost £29 per mile in a district where the main roads cost £111 per mile, and from the point of view of efficiency £29 per mile was miserable. They would say, "Why don't you make them efficient?" The fact was that the finances of local government were such, and the demands of the county were such, that they were aware the rate-payers were already paying as much as they could well do to-day. If they were the County Council managing those roads it would be a different affair. They would take the view of Mr. Hawkins, and not be weighed by considerations of pity or charity. He noticed that the writers of the papers were very liberal in the epithets they applied to the state of the law, and he had looked for suggestions as to where the law failed, but found an absolute blank. He (the speaker) thought the Highway Act of 1835 a very excellent Act, and he did not see how they should get on without it. No doubt there were points in which improvements should be made, and he expected to hear from practical men in what direction the

highway law required amendment. In Berkshire, if they wished to do a little more in the way of dust laying, their practice was to expect those who benefited to contribute something towards it. He was bound to say he had not much fault to find with the present law. As to road side wastes, which had been referred to, they could not have these things settled by statute law. If real questions of law were involved, they would have to be settled by reference to the common law of England, or, if necessary, application must be made to the Courts. As to Rural District Councils, they did their work loyally and thoroughly and to the best of their ability, but, of course, their position could not be as independent as that of the County Councils, and they could not expect the same calibre of men on them as they got on the County Councils.

Mr. GLADWELL, in reply, said the last speaker had quite correctly summed up the issue between the two papers. He and Mr. Hawkins had advanced directly contrary opinions, but he thought they quite agreed as to the necessity for classifying the roads of the country and codifying the highway law. If the Act of 1835 was necessary then, it was necessary, considering what had happened since, that the law of the land should be brought reasonably up to date. He had come in for some criticism with respect to his views on the illegal maining of roads. Perhaps the use of the word "illegal" was a little unfortunate, but it was not incorrect. He believed the whole of the trouble and difficulty raised in connection with the extensive declaration of main roads was focussed in the one unfortunate term "otherwise." He had taken part in a conference on the question of the highways at which the case of Hertfordshire (mentioned by Mr. Horton) was mentioned, and it was agreed that the indiscriminate declaration made in that case was clearly illegal. He did not say they were wrong from the point of view of policy, but they were certainly wrong as regarded the provisions of the Act under which they worked. What they wanted was a proper classification and standardisation, and until they got that they would continue to have different forms of practice both in administration and control. He did not advocate State control in the sense of State management, but it was quite obvious that if the State contributed money they would want a certain amount of control. He thought it ought to be very slight, and entirely confined to seeing that the money collected was expended for the purpose for which it was allocated.

Mr. HAWKINS, in his reply, stated that after hearing the discussion he still held to his principles, and he said that the only way to obtain efficiency and good roads was to put them under one authority in the different counties. He knew that the County Councils worked hard, and that the Poor-Law Commission was going to put more work upon them, but he felt certain that in spite of that they could do all the work

asked of them in a large-hearted way, and thoroughly well. As to the remarks of Mr. Chapman, he did not think Lancashire could be compared with other parts of England. Dealing with what Mr. Gowan had stated, they knew that Croydon was practically an urban district, and he believed that urban powers prevailed in the greater part. Mr. Gibbons seemed to suggest that his (the speaker's) experience with District Councils had not been very pleasant. His experience when he was a district surveyor was very pleasant. One, however, ought to air one's views if they thought it desirable, and stick to the truth if they considered there was a benefit to be obtained. He hoped that the few people who appeared to be against him would in their leisure hours take the opportunity of reading through his paper again. It was, to his thinking, much better to have 67 road authorities than 707.

The CHAIRMAN observed that they were indebted to the authors for the papers, and also to the gentlemen who had taken part in the discussions and given them the benefit of their valuable expert opinion. He thought that the opinion expressed that morning was emphatically against the setting up of a central department with large powers of control and interference. His own county (Warwickshire) had made several representations against the establishment of a central department, and he was quite certain that the general opinion was the same throughout a large number of counties. But they must bear in mind that the ratepayers of the kingdom were getting exceedingly restive on the subject of the maintenance of the highways, the cost of which had been so largely increased by all forms of motor traffic. What he thought they ought to try and concentrate their attention upon was to obtain considerably larger aid from the central authority for the maintenance of the main arteries, and the problem of how this end was to be attained merited the serious consideration of the Conference. No doubt they would have to submit to some form of inspection, as little as would conduce to the Government giving them the maximum amount of aid. That, he thought, they must agree to, else they would not get the desired help for the ratepayers. Another point on which he thought the Conference would be entirely of one mind was that the time had arrived when there should be a codification and consolidation of the existing highway laws, with certain amendments therein. What those amendments were he would not go into, but some general resolution on the subject could certainly do no harm, and it was to be hoped it would result in making the administration of the highways simpler and easier than it had been in the past.

SECTION A.

EXTRAORDINARY TRAFFIC.

CHAIRMAN :

VISCOUNT VALENTIA, C.B., M.P.

SECRETARY :

G. WAINWRIGHT.

TECHNICAL SECRETARY :

ALLAN STEVENSON.

Papers 29, 30, and 31 were taken as read, as follows :

PAPER 29 : BY W. JOYNSON-HICKS, M.P.

The question of extraordinary traffic has of late years become a somewhat complex one, partly by reason of the amendments of the section of the Act dealing with the subject, but mainly because of the numerous decisions that have been given by the Courts, not only as to the liabilities of those who conduct extraordinary traffic, but also as to the duties of road authorities in connection therewith.

In the year 1861, when locomotives were likely to become common on the highways, the Legislature appear to have anticipated that great damage would result from their use. It was accordingly thought prudent to enact that if the use of any particular locomotive caused excessive wear and tear of the highways, the Principal Secretary of State might by order prohibit the use of any kind or description of locomotive specified in such order on any highway whatsoever (1861 Act, Section 5).

Apparently, it was found in practice that the use of locomotives constructed in accordance with the statutory requirements did not cause that amount of damage which was expected, and the provision as to wear and tear was repealed four years later (1865 Act, Section 2).

It was not until the year 1878 that extraordinary traffic was again dealt with by Parliament.

Section 23 of the 1878 Act as amended by Section 12 of the Act of 1898 is the basis of all extraordinary traffic claims. It is very general in its terms, and applies with equal force to all and every kind of traffic; it is wide enough to include anything from a pannier donkey to the traction engine whose proud owner christens it with such a name as the "King of the Midlands"; it holds in its meshes traction engines, motor lorries, and the humble brick-cart. It is the road authorities' charter, and having regard to its general and vague terms it has yielded a fairly full harvest to the lawyers.

After a period of some years many of the points arising under the section were, by reason of legal decisions, laid at rest, but not

a few were resurrected in a different form by Section 12 of the 1898 Act.

The 1898 Act altered the period of limitation, but this amendment has given rise to many decisions, and has raised very difficult questions on two important points—viz. : (1) whether or not the damage was the consequence of a particular contract or work extending over a long period, and (2) if so, at what period was such contract or work completed.

Another point which the 1898 Act resuscitated was the question as to who was liable. Lord Gerard's case (*Gerard v. Kent County Council*, 1897, A.C., p. 633) practically settled the point under the 1878 Act, but it was that decision which brought the amendments effected by the 1898 Act into being, and by that amendment it was enacted that the persons liable should be those by whose or in consequence of whose order the extraordinary traffic had been conducted. This seems to have given the road authority the right to sue (a) the building owner, (b) the builder, (c) the traction-engine owner, (d) all three of such persons.

The main question as to whether the traffic complained of is ordinary or extraordinary is one of fact—it is difficult to see how it can be made otherwise—and consequently on this question each case must rest on its own merits.

Briefly, to summarise the law, the road authorities must have regard to the following matters :

1. They must so far as they are concerned be satisfied that the traffic complained of is extraordinary.

2. They must determine who are the persons or person by or in consequence of whose order the traffic complained of was conducted.

3. They must have regard only to the traffic using the particular road in respect of which the claim is made (*Etherley Grange Coal Company v. Auckland District Highway Board*, 1894, 1 Q.B., page 37).

4. They must prove the nature of the ordinary traffic.

5. They must take into account in arriving at the cost of ordinary repairs any additional cost occasioned by an increase in the ordinary traffic (*Hemsworth Rural District Council v. Micklethwaite*, 68 J.P., 345).

6. They must charge against the defendants nothing beyond the amount necessary to put the road into such a state of repair as would bear the ordinary traffic.

7. They must take into account any increase in the cost of labour or material, any increase of expenditure due to abnormal weather or other abnormal conditions.

8. They must take care that all persons conducting extraordinary traffic bear their proportionate burden of the cost.

9. They must determine whether the damage arose from the carrying out of a particular contract or work extending over a long period, and commence the action within the proper period.

10. They must see that the money has been expended before the surveyor gives his certificate.

I do not think that anyone will dispute that it is by no means a light or enviable task for a road authority to so frame a claim that it can survive the ordeal of criticism in the Law Courts.

I have been professionally concerned in many extraordinary

traffic cases, and in the course of them I have been brought into contact and at times in violent collision with road authorities. I am bound to say that my experience convinces me that in cases of undoubted extraordinary traffic there are too many difficulties in the way of road authorities, and in cases where traffic though heavy is not in fact extraordinary, the difficulties placed on the shoulders of those responsible for such traffic are too burdensome.

Having regard to the greatly increased use of our highways, in my opinion a more comprehensive Act should be passed giving some real guidance to road authorities as to their rights and liabilities in connection with traffic over their roads.

The question of the nationalisation of main roads is one that has often been discussed, and I believe the principle receives the support of many leading authorities on the question of road construction and maintenance. As a step to this end, I advocate that with regard to main roads they should all be in the hands of the county authorities.

Such a course would, I think, tend to minimise some of the difficulties arising in connection with the subject in question.

On this point I might refer to a recent case not yet decided, where through traffic from one town to another along the main road has been the subject of practically two claims, owing to the fact that between those two towns there is a length of road maintained by a local Council assisted with a grant by the County Council, if the County Council succeed in such a case, then, of course, the local Council will bring a further action, which, by reason of the legal costs, though successful, may result in no benefit to the ratepayers in whose interest the action is really brought.

With regard to traffic which in most cases is extraordinary, such as that in connection with the building of a large mansion, or the construction of a factory, or such works as reservoirs, necessitating heavy traffic over roads otherwise comparatively little used, I think that the owner or contractor should pay, unless it is in a district where traction engines or heavy motors are common, in which case the road authorities should keep or make all their roads suitably strong.

As to traffic in connection with a local industry or traffic merely involving a change in the method of hauling, it should be open to the Court to consider how far such traffic is connected with an industry which confers benefits on the neighbourhood in which it is carried on, and that relief should be given so that such industry should not be stifled by claims for extraordinary traffic.

I have recently been concerned in such a case, and the persons against whom the extraordinary traffic claim was made carried on a great industry in the district, they paid a very large proportion of the rates collected by the Council making the claim, the bulk of their traffic was sent over the local railway, and yet they were persistently prosecuted by the local Council; but when the case came before one of the ablest judges of the High Court, he animadverted on the conduct of the Council in pressing such a claim, and stigmatised the section of the Act when applied to such a case as an odious one.

But what of the road authority which is composed of small-minded men who hate traction engines as much as we suppose

they do the author of all evil, and whose one main idea is to starve the roads and keep down the rates? The kind of road authority who lays down metal (generally inferior local stone) on its roads and leaves the pneumatic tyres of the motor traffic to roll it in.

One of these gentry on being remonstrated with by me, replied, "Oh! but we don't want to encourage motors in our county." Equally they "don't want to encourage" heavy mechanical traction in their county, entirely oblivious of the fact that they are trying to stop the march of commercial progress, and to retain their county in a condition not far removed from that of the Middle Ages.

These old-world county councillors have been by the action of the courts of law gradually aroused from their slumber by various decisions, each one gradually shifting the onus of providing adequate roads a little further until at last we have arrived at what I consider an almost fair obligation on the road authorities.

In the early days of traction-engine cases we had to prove that the traffic was ordinary upon the road in question, and one of the judges went so far as to say that the traffic that was extraordinary never could by the lapse of time become ordinary, quite oblivious of the fact that in that case the first wheeled cart could never have become ordinary traffic. However, this dictum was never seriously regarded by the legal profession. Then we got as far as justifying traffic if it occasionally used the road in question, provided it was the usual traffic of the district. Finally, we have travelled so far towards a common-sense interpretation of the duties of road authorities that they must keep them in such a state as to be strong enough to carry the traffic which they as reasonable men ought to expect upon it. This was the decision in the case of Attorney-General *v.* Scott, where the road authority sued the defendant for being a nuisance, insomuch as he had churned the road up to such a condition that it was absolutely impassable. The answer of the defendant was: "No, it is not I who am the nuisance, but you, because you ought to have known that stone quarrying was the traffic of the district, and that traction engines would use your road, and therefore you ought to have made it up sufficiently strong to bear the weight I carried."

This always seemed to me to be common sense, and now it is common law.

The next subject which owners of heavy traction vehicles will have to take into consideration will be the bridges which span railways and canals. I will not enter into it fully, as it is even more important and perhaps more technical than roads, and likely to involve, before it is settled, even bigger litigation.

The attitude adopted by the railway and canal authorities seems to be that they have only to let a bridge get into disrepair to entitle them to put up a notice warning heavy traffic not to go over it, and in doing so they have entirely cut different parts of the country off from their neighbours.

In my opinion the gradual establishment of the law relating to roads will enable us to carry on the same line of argument in the Courts, and compel the owners of bridges which cut through the King's highway to keep such bridges up to the standard of the highways on either side of them.

Take a road which originally was a country road. The railway cuts through it and carries the road over on a bridge. It is quite

true that this may have been done when there was no heavy traffic, but as the traffic increased and the construction of the road was improved, it is quite clear that but for the block created by the bridge the road would continuously have improved; and I have every reason to believe that when a case comes before the final Court of Appeal we shall be able to establish the proposition that the owner of a bridge who for his own personal benefit is allowed to cut into and to that extent create a nuisance upon the highway, must keep it up to the standard of the highway and sufficiently strong for the needs of the traffic travelling along the same highway.

In conclusion, I would merely add that all users of roads are enormously indebted to the owners of heavy traffic for having caused the great improvement which has undoubtedly taken place in recent years in the construction of the main roads of our country, and it is well that road authorities and road engineers should realise, as I believe they are beginning to do, that such improvement not merely cannot go back, but must be yearly progressive.

PAPER 30: BY W. H. SCHOFIELD, ASSOC.M.INST.C.E., COUNTY SURVEYOR OF LANCASHIRE.

In submitting this paper I do not propose to enter into the legal points which are involved, but rather to deal with it from the point of view of a surveyor whose duty it is to repair and maintain roads which are largely used by this form of traffic.

It is certain, however, that the recovery of damages alleged to have been caused by extraordinary traffic has been the subject of litigation in a considerable number of cases during the past few years, and the uncertainty of the result, together with the heavy costs incurred in fighting these claims, has, no doubt, deterred many surveyors from advising recovery of money to which they feel they have a just and equitable claim.

Presuming the preliminary pitfalls of the surveyor's certificate and the commencement of proceedings within the specified time are got over, there are other complications which may arise which make it difficult to lay a claim which can be easily substantiated.

A case which happened in my own county will, perhaps, illustrate my meaning more clearly.

A firm of contractors entered into a contract for the building of a large public institution near a certain main road, and in carrying out the works, which extended over a period of rather more than two years, they conveyed their building materials over considerable lengths of two separate main roads of quite different character by motor wagons, doing considerable damage to both of them. Unfortunately for the county, almost simultaneously the extension of another large public institution was commenced by another firm of contractors on one of these two main roads, conveying exactly the same class of materials, but chiefly by horse-drawn vehicles. It was found to be impossible to prove the extent of the damage caused by each contractor on this particular main road, and although a claim could undoubtedly have been substantiated against each of them if the respective

contracts had been carried out at different periods, we were advised to eliminate that portion of the expenditure from our claim against the first contractor and to make no claim against the other, and thus the county had no remedy, although the actual damage to the road was considerably increased.

We have had at least three cases of this type during the past four or five years.

A serious practical difficulty in preparing a claim for extraordinary traffic is presented by the wording of Section 23 of the Highways and Locomotives Amendment Act, 1878.

In this county, at any rate, no comparison of the cost of the maintenance of a main road which would be of any use could be made "with the average expenses of repairing highways in the neighbourhood," and the comparison of the cost of maintaining one main road with another in the same neighbourhood would also be futile. The only equitable comparison, therefore, is that of the cost of maintaining the same road both before and during the continuance of the extraordinary traffic, and possibly for a subsequent period.

Traction Engines.—There has, I find, been no very large increase in the number of traction engines licensed in Lancashire during the past few years. The following is a list of those at present on our books :

| | |
|---|-----|
| Agricultural locomotives registered | 158 |
| General haulage locomotives licensed | 32 |
| General haulage locomotives for which additional licences were taken out during the past twelve months | 10 |
| Daily permits issued during the past twelve months | 222 |

Although the number of traction engines has not seriously increased of recent date, the same cannot be said of the weights which are now being conveyed by these locomotives over our roads.

During the past six years upwards of 60 new cotton mills have been erected within the geographical county of Lancashire, and the provision of steam boilers for these mills alone has caused a serious increase in the number of extremely heavy loads conveyed over our main roads.

According to the report of the evidence given before the Select Committee on Traction Engines on Roads, which was issued in July, 1898, the average weight of steam boilers was then about 20 tons, whilst to-day very few boilers are made of less weight than 20 tons ; they very frequently run up to 36 tons, and some few cases to 39 tons in weight.

Under Section 1 (3) of the Locomotives Act, 1898, it is provided " that the regulation of weight herein mentioned shall not extend to any wagon carrying only one block, plate, cable, roll, vessel of stone or metal, or other single article being of greater weight than 16 tons, etc., etc., and any damage arising from the user of any such wagon shall be deemed to be damage caused by excessive weight within the meaning of Section 23 of the Highways and Locomotives Amendment Act, 1878, as amended by this Act." So that under the foregoing section traffic such as this is deemed to be "extraordinary."

Under the Locomotives Act, 1898, the County Council must, on application, license any locomotive weighing under 14 tons if the same is properly constructed, and they have afterwards practically no control over it.

In case of a locomotive weighing over 14 tons however, the County Council may refuse to license altogether, or if they do issue a licence they may make such conditions as they think fit.

This county refuses to issue licences for locomotives weighing over 14 tons, except under the following conditions :

1. That the locomotive shall only be used for the purpose of drawing a single indivisible article which could not be drawn by an engine less than 14 tons.

2. That any question as to damage to the roads caused by extraordinary traffic, or excessive weight, shall not be the subject of an action, but shall be settled by a single arbitrator to be appointed by agreement, or, failing agreement, to be nominated by the president for the time being of the Institution of Civil Engineers.

3. The owner of a locomotive shall send a written notice to the county surveyor at least two days before each occasion on which it is intended to use the locomotive on a road within the administrative county, stating the route intended to be traversed.

4. The owner of the locomotive shall as far as possible refrain from using the locomotive on a macadam road when the condition of the road is unfit for such heavy traffic.

Under these conditions it has been possible to obtain fairly accurate information as to the number of journeys made and the weights conveyed by these particular engines, as well as the route proposed to be traversed.

During the period from March 31st, 1906, to February 28th, 1909, 412 boilers were conveyed by locomotives owned by six firms along our main roads, and of these, three firms were amongst them responsible for 350.

The weight of the train, including engine, bogie, and load, varied from 48 to 67 tons, whilst the length of the main roads traversed within the administrative county varied from $2\frac{1}{2}$ miles to 23 miles, the average of the whole of the journeys being $9\frac{3}{4}$ miles.

On one occasion two boilers, each weighing 22 tons, were conveyed at the same time by one engine weighing 16 tons, the total train load being 80 tons.

The local surveyors were notified of the proposed conveyance of each particular load through their respective districts, and in nearly every case the engine was followed and the damage noted, but the sum total of the damage returned as having been caused in each district in each individual case was too small to make it worth while sending in a claim.

The fact that the main roads are sufficiently strong to carry these weights without either breaking through the crust or depressing the foundations appreciably is clear, and consequently the apparent surface damage for which a claim could be easily justified was small, but I do not think that it can be reasonably argued that this apparent damage is by any means the whole of that which has occurred.

If the road foundations had been weak or the surface coating thin, there is no doubt this traffic would have caused damage which would be easy to see and probably expensive to repair, and the cost of reinstatement could have been recovered.

Where the road is strong, however, the crushing of the macadam surface, which undoubtedly takes place with extra-

ordinary weights such as these, has the effect of considerably shortening the life of the road, but for such a damage there is, unfortunately, no compensation under the present law.

One good result at least has been obtained from the close supervision of these six locomotives—viz., that the owners have kept the wheels in good condition, and so minimised the damage as much as possible.

We have no record of the journeys made by the remaining 36 locomotives which are under 14 tons in weight, as we cannot legally require these particulars to be furnished to us, and we consequently are not in a position to judge what the total number of these heavy loads passing over our roads amounts to, but I do not think it would be unreasonable to ask that in the case of heavy indivisible articles such particulars should be furnished to us.

Our income from the licences of heavy locomotives for the last completed year amounts to £692, a sum which is absolutely insufficient to compensate for the amount of damage done.

Heavy Motorcars (Motor Wagons).—This type of heavy traffic has increased rapidly in this country during the past 3 or 4 years.

It is, I am sorry to say, almost impossible to give an accurate statement of the number of motor wagons using our roads, owing to the manner in which they are at present registered.

We have, however, 104 wagons registered with the county in the names of Lancashire firms, and there are 224 others registered by the county borough authorities within the geographical county. The county of Chester has also registered 50, and the county borough of Leeds 29, all in the names of Lancashire firms; and there are no doubt many others similarly registered by the counties or county boroughs in which they are manufactured, and which are using our roads.

I think, therefore, it would be no exaggeration to say we have upwards of 450 motor wagons using the main roads in this county very regularly.

The effect of these heavy vehicles with small diameter wheels, travelling at a comparatively high rate of speed, has been in many cases most marked.

It is quite certain that the total damage caused by motor-wagon traffic in Lancashire is far in excess of the total damage by traction engine, and I am not so sure that this state of affairs is due altogether to the fact that we have a greater number of the former.

It is difficult to say what proportion of the additional wear should be ascribed to the motor wagon itself and the proportion due to increased traffic, as there is no doubt whatever that the greater bulk of it is traffic which has hitherto been dealt with by the railways.

I can, however, point to a few cases where the goods from a particular mill were originally conveyed by horse-drawn vehicles, for which motor wagons were substituted.

These roads were in a thoroughly sound condition, and carried the ordinary vehicular traffic, including the traffic from these mills, quite satisfactorily, but immediately the motor-wagon traffic commenced the cost of maintenance was very substantially increased.

In the populous portion in the south of this county we have hitherto had a very considerable mileage of main roads paved with local millstone grit setts, and the effect on these lengths has

been deplorable, the setts having been either broken or crushed in a wholesale manner.

The conclusion I have arrived at is, that it will be economical in the future to pave with granite setts any road which has to carry 35 to 40 motor-wagon loads per day, such as are common in Lancashire, in addition to only a moderate ordinary vehicular traffic.

The annual income received for these motor wagons barely pays the cost of registration, so that the whole burden of the added maintenance charges falls on the shoulders of the general ratepayer.

My personal opinion is that the owners of these heavy motor wagons ought to contribute substantially either by payment of an annual licence fee, or by some other method, towards the extra cost which we are now being put to in reconstructing and maintaining these roads to suit their abnormally heavy and destructive traffic, and, further, I think the resulting damage would be appreciably reduced by enlarging the wheel diameter.

PAPER 31: BY R. J. THOMAS, M.INST.C.E., COUNTY SURVEYOR OF BUCKINGHAMSHIRE.

The author deals with this subject in its relation to roads in rural counties, light in construction, but capable of sustaining the ordinary traffic of the district. It is understood that the conditions obtaining in populous and industrial localities, where the nature of the traffic is heavy, will be discussed by other writers.

There has been in recent years an appreciable increase in extensive injury to country roads, attributable not only to a greater number of specific cases of exceptional traffic, but particularly to the passing of the 1898 Locomotives Act and the Motorcar Act and Orders of 1903-4.

This exceptional traffic on roads may be broadly divided into three classes:

(a). The temporary user of a lightly constructed country road for conveying materials to the site of extensive building, sewerage, water supply, or other constructional works. As contracts for such undertakings invariably require their completion within a stipulated period under penalties for default, contractors must, in their own interests, keep up a regular supply of materials, thus subjecting the roads traversed to constant heavy traffic, irrespective of the weak condition to which rain or break up of frost may have reduced them.

(b). Heavy traction-engine traffic under daily permits issued in accordance with Section 9 (9) of the Locomotives Act, 1898.

That traction engines, if licensed in one county, may traverse roads in any other county at the nominal charge of 2s. 6d. per day (a sum barely sufficient to meet office expenses in issuing permits), has undoubtedly caused many and increasing cases of extraordinary traffic and excessive weights, and light country roads are now, at unexpected and irregular times, utilised by this traffic. As an instance, the author had recently through the county of Buckingham, *en route* from the Midlands to London, a 32-ton boiler on a trolley weighing 8 tons, and having wheels less than

2 ft. 6 in. diameter, drawn by two 12 or 13 ton traction engines ; a gross weight of some 64 or 66 tons ! As this occurred during the break up of a frost its effect may be imagined.

The growth of this class of traffic will be appreciated when it is stated that, from returns recently obtained by the author, more than 22,000 daily permits for traction engines were issued in England and Wales during the past 12 months.

As permits are generally applied for to the clerk of the council the day before, and often on the actual day of haulage, it is difficult, if not impossible, for the surveyor to arrange for observing the passage of a specific engine along his roads, hence damage is often undiscovered until later, when probably other engines have traversed the same road, and it is therefore impracticable to allocate the cost of restoration between them.

It is urged that applications for permits should be sent in at least three days in advance ; that they should state the route intended to be taken, and give the weight of the engine and load ; that a heavier fee be charged, regulated by the gross weight, and that the road authority have power to refuse permits for traversing light roads when their condition is totally unfit for heavy traffic.

(c). A change in the weight of loads carried and in the vehicle employed.

Where a road capable of taking its ordinary traffic is injured by regular journeys of newly introduced heavy vehicles belonging to one owner, and there is no indication or sufficient ground for supposing that others will adopt such methods of haulage, the Courts have decided (in the Salop case and also the recent Geirionydd appeal) that where old-fashioned traffic is conducted in a new manner which either increases the wear of a road, or places heavier loads upon identical vehicles with similar results, the costs incurred in making good after such traffic can be recovered, presumably as long as there is no additional user by similar traffic.

It is obviously a case of individual user against the public at large : a manufacturer finds it cheaper to transport his goods to his branches by traction engine than by rail, and, as the price of such goods to the consumer remains the same, makes an additional profit, though at the same time necessitating increased expenditure by the road authority.

When, however, new industries arise or developments and changes take place in the general character of a locality, the frequent result is the general adoption of heavier loads transported by means of self-propelled vehicles of considerable weight. If the roads traversed have no reserve of strength beyond that which successfully sustained all previous traffic, such rapid increase in additional weights and new methods of haulage must undoubtedly do extensive injury, and necessitate considerable strengthening in such roads, if not complete reconstruction.

These cases are the most difficult to deal with as between the general public and the individual trader.

It is obvious that no country road authority in whose area traction engines are little used would be justified in strengthening their roads in excess of full existing requirements, in speculative anticipation of a sudden influx of heavy self-propelled traffic.

That the entire cost of reconstructing a road injured by what may fairly and reasonably be assumed to be a "forerunner" of

coming methods of haulage should be charged to such vehicle would be manifestly unfair and unjust, and the author is of opinion that only the cost of all surface repairs necessitated by such pioneer traffic should be borne by the owner of the vehicle, the road authority undertaking the additional foundation and other work necessary for providing traction-engine strength.

It is exceedingly difficult to decide when the volume of traffic or number of heavy vehicles conveying it has continued long enough to be deemed the ordinary traffic of the district, and it is believed that no definite rule can be made applicable all round, but that each case must be considered upon its own merits and the varying local conditions.

As there are registered in England and Wales over 7,500 agricultural traction engines, 1,100 general haulage engines are licensed annually, and, as stated, make some 22,000 journeys per year outside their own counties, and some 4,500 heavy motors are registered (at a nominal fee of 2s. 6d.), it is abundantly evident that heavy traffic is increasing rapidly, and that all main trunk roads will soon have to be up to traction-engine strength, if such traffic is not to be discouraged. It is in the user of light country roads, which form the majority of public highways, that such exceptional traffic should be regulated, and much can be done in this direction by the passing of by-laws—subject to confirmation by the Local Government Board—under Section 6 of the 1898 Locomotives Act, closing weak and least suitable roads to traction-engine traffic, either during the winter months or permanently.

No paper on extraordinary traffic can exclude reference to the excessive injury done to rural roads by mud and dirt dropped upon them from wheels of vehicles coming off heavy land, etc., the surface metalling being torn up extensively by other wheels when they pass over such adhesive mud. As no successful prosecution under Section 73 of the 1835 Act has taken place, so far as the author knows, and the Home Office quite recently expressed the opinion that it is not competent for a County Council to make by-laws prohibiting or restricting such user of a highway, an amendment in the law can alone abate what is unquestionably a source of considerable extra expenditure to rural road authorities.

There is also the phenomenal growth of fast motor traffic on pneumatic tyres with steel projections. An inspection of some of the French "Routes Nationales" last autumn revealed the extraordinary effect of this traffic, and in this country equally grave results are visible. A motor engineer in a recent paper gave illustrations of injury done to London asphalt, and ruts cut inches deep on a hill in Hampshire by these tyres.

As it is almost impracticable to recover the cost of restoring roads injured by such traffic, in consequence of the difficulty of allocating any proportion to a given car among so many, it is urged very strongly that some portion of the additional expenditure necessitated by this traffic should be contributed by those responsible for it.

Considering the subject of restoration after extraordinary traffic in more detail, road authorities have imposed upon them the duty not only of restoring injured roads to their former condition when any exceptional user has terminated, but also of executing during such haulage all temporary repairs necessary for the safe and

unrestricted passage of the ordinary traffic of the district. In the author's experience a large proportion of the expense and most of the disallowances in these cases occur in this portion of the work, and it cannot be too strongly urged that particular care be taken during such period, not only to record the daily traffic, weather, etc., but also in minute detail the work executed in temporary and oft-repeated repairs.

When the surface work has been completed it is difficult to show the extent to which such repairs have been effected, and it frequently occurs that a judge, jury, or arbitrator is slow to accept the fact that the quantity of material charged for has been used in temporary filling of ruts and holes, or, in the alternative, that it was necessary.

It is also contended by those responsible for such injury that the additional thickness of hard material put into the roads in filling such ruts, etc., is in the nature of "betterment."

This additional material being required in the bed of the roads in consequence of and during extraordinary traffic, its cost should not be borne by the road authority, to whom it would be superfluous, as the roads and their foundations were strong enough for ordinary traffic prior to such exceptional user, and would have continued so.

Along narrow roads traffic of unusual weight will force the metalling lying between ruts and gutters outwards into soil at sides, with which it is too often churned up and ceases to afford lateral support. In such cases it is essential that this useless mixture be removed and hard rubble substituted for the future stability of the road. This has indirectly the effect of widening the metalled road surface in excess of previous and probable future requirements. Material and work are thus wasted as a direct consequence of such traffic, and should be paid for by those responsible for such exceptional user of the road.

In conclusion, the author believes that a material change is necessary, in the interests of all parties, in the method of ascertaining and recovering expenditure incurred in restoring roads injured by extraordinary traffic.

He is of opinion that, prior to the commencement of haulage of exceptional character in weight or total quantity transported, the person by or in consequence of whose order it takes place and the road authority shall agree upon the price to be paid should injury be done. In the event of disagreement they shall select a competent and impartial arbitrator, or, failing agreement, such arbitrator shall be appointed by the Local Government Board, on appeal by either party.

It shall be his duty to—

1. Inspect the roads prior to such haulage, ascertain whether they are sufficiently strong for local traffic, carefully examine and note their condition, cross-section, thickness, and quality of metalling, surface drainage, foundation, character of subsoil, etc.
2. Pay periodical visits to the roads during progress of such haulage, have access to all books and accounts, and be supplied with any particulars of expenditure, weights of material hauled, etc., he may desire.
3. Determine the amount (if any) to be paid.

It is believed that by this method the interests of the person responsible for the traffic would be safeguarded against claims

for unnecessary or extravagant work, and road authorities would be protected from loss in expenditure incurred when carrying out their statutory duties.

Doubtless there would be instances where the arbitrator's services would not be required in their entirety in consequence of mutual agreement, or the absence of appreciable injury to the roads used, but the amount represented by fees so forfeited would be but an infinitesimal portion of the costs incurred by present methods of procedure.

It is asserted with confidence that neither a judge, jury, nor arbitrator can possibly be in a position to mete out justice in these cases, unless possessed of the local knowledge, details, and particulars enumerated above.

DISCUSSION.

The CHAIRMAN, in opening the proceedings, congratulated the Conference upon the statement made on the previous day in Parliament by the Chancellor of the Exchequer, that compensation was to be made to the local authorities for road making and maintenance. That they would receive substantial assistance he doubted, but it was the thin end of the wedge; and if it was conceded that some assistance was required from the Imperial Exchequer it was a step in the right direction, and he hoped it would be followed by some further concessions in the future. The papers were most ably written, and he was sure that all who had read them would agree that they contained a great deal of information and experience common to them all; but he should have preferred if some suggestion had been made as to the advisability of drawing up a resolution on the subject dealt with by the papers, and submitting it to the central meeting. However, some form of resolution might suggest itself in the course of the discussion.

Mr. WOOD HOMER (Central Chamber of Agriculture) said he had read through the three papers with considerable interest, and he thought they would all agree in one thing, and that was that the subject dealt with was one surrounded with very great difficulties, and that the costs incurred by County Councils and other road authorities through extraordinary traffic were very often excessive. Mr. Joynton-Hicks declared that the subject had become complex, and Mr. Schofield referred to the large amount of litigation it incurred and the difficulty of the recovery of damages. The third paper gave a great deal of interesting information with respect to the question. As far as he could see, none of the authors had come to any definite conclusion as to what the remedy should be. He (Mr. Homer) would refer to an instance which occurred under his own observation. A

contractor was putting up a large building for the county, and in order to cover a possible claim for damages to roads he made the total of the contract £2,000 extra. He went over some miles of main roads, and quarter of a mile of District Council roads. The amount recovered by the District Council was several hundred pounds, but in the case of the County Council it was very little. In any case the ratepayers were considerably out of pocket by the whole transaction, because they did not get the whole of the £2,000 charged for possible damage in the contract. He could give other instances of the exceedingly curious working of the law, but those present had possibly as much experience as he had had. His suggestion was that the law relating to extraordinary traffic should be altered in the direction of placing all engines using the roads on the same basis, whether new or old traffic. Buildings erected were often public buildings, or large mansions that would contribute to the rates, and tend to develop a neighbourhood, and the traffic was constantly becoming ordinary traffic. To meet this the roads must be standardised, and Class 1 should be strong enough to bear all descriptions of traffic, and must be kept up to the mark. Traffic roads should be maintained at the cost of the central authority, who should contract with the County Council to keep them in order. The second-class road should be under the local authority, with inspection by the Government, who should pay at least half of the cost. The third class of roads would be those maintained by the local authority. Claims for damages should be against those who employed engines and motors beyond the capacity of the roads. If they ran these on a third-class road, which could not bear them, they did so at their own risk. This should apply to farmers' carts as well as to motors. He might say that Mr. John Burns had held out a hope, and he would be willing to assent to such a proposition as that, and he (the speaker) thought this would simplify the question as between Urban District Councils and County Councils, as the Urban Councils would not have the troublesome audit of accounts which they had at present.

Mr. HUTCHINS (Montgomeryshire) asked how the matter would stand as to the carrying of stone. In his case a neighbouring council carted stones on six miles of his Council's roads instead of 16 miles of their own. They carried four tons, including a four-horse wagon.

The CHAIRMAN: Do you suggest it is extraordinary traffic because it comes from the neighbouring county?

Mr. HUTCHINS: No. Because it is excessive weight—between 30 cwt. and 4 tons.

The CHAIRMAN: Speaking off-hand, I don't think you could look upon that as extraordinary traffic.

Mr. AVELING (Royal Automobile Club) said there was a sure and easy method of freeing oneself, if the user of a heavy engine on the public road, from the heavy claims made on users by road authorities. The man who owned

two or three road locomotives formed a company with the members as debenture holders, and when the owners of the engines received a claim in respect of extraordinary traffic they simply liquidated the company, and the result was that there was nobody with whom the claim would lie. The law was that the claim was to be made on the "owner." If an owner could escape by forming a company such as he had described, there should be a provision to force the user of the roads to give a guarantee to enable the road authority to recover the cost of any repairs caused by his extraordinary traffic. As to moving very heavy boilers, that was a matter that was brought to the attention of the Legislature, and he knew of no other way of moving these except by the means or method mentioned in the paper. If an extraordinary charge was made on the users, they increased the price of the contract for delivering and erecting the boiler. Mr. Schofield brought a certain amount of complaint against heavy traffic, and especially against heavy motor wagons. He thought that as to these the remedy was in the Heavy Motorcar Order. If the wagon was running at a speed beyond that allowed by the order it could be stopped, and when it was weighed the weight would probably be found to be illegal. So that the surveyor could exercise his own powers under the order.

Mr. HOGG (Elgin) had had a great deal to do with this matter for 30 years, and he could say that to take a case before the Courts in Scotland was, as he supposed was also the case in England, one of the most disappointing proceedings any Council could take. So much was this the case that the Council of the county in which he was would not bring any case before the Court, because they said they always lost. If they won the case, they got a small portion of the claim and had to pay a large share for expenses. The law in Scotland was recently improved, as it had been in England. Formerly the claim might be settled by the sheriff, without appeal. Some sheriffs, however, settled one way and some another. Now an appeal could be made to the head Court in Edinburgh, but he did not think this had resulted in any improvement. He did not think it was a matter lawyers could deal with, as the number of expert witnesses completely bamboozled the judges altogether. It seemed to him that the proper way to deal with the matter was to have the road thoroughly examined before the traffic commenced by the road surveyor and others who had a knowledge of the roads. The camber, height, and width should be taken. As soon as the road was in a dangerous state another examination should take place, and the local surveyor should be advised by his assistants to take counsel for the repair of the road. After the road was repaired it should be inspected again. Many cases might be settled by following such a plan. Also he should recommend that when a claim came before a judge he should have an assessor by his side, as was the case in

navigation law, because it seemed to him that individually a judge was not capable of handling such cases.

Mr. LANE (Sussex) remarked that they might have any number of inspections of the road, but how were they to fasten the liability on any particular motor engine? The road might be used by a dozen different traction engines. He thought it would be better that the owners should pay a certain amount before they started, and then they would know where they were.

Mr. KELLY (Liverpool) said he had some experience in this matter outside the Liverpool boundary on four miles of main road. A sum of £20,000 had to be spent on it to put it in anything like condition, and as a penny rate did not bring in more than £500 they might imagine the difficulties that arose through the extraordinary traffic. They fought the parties three times, but eventually they thought it better to give way rather than incur such heavy legal costs. Speaking generally, he thought it was a matter in which they were entitled to be assisted, as undoubtedly traction and motor traffic had come to stay.

Mr. McGRATH (West Riding) agreed that it was generally the wisest thing for the local authority to come to some arrangement with the owners of heavy traction engines as to the compensation they were to pay. They had done this in the West Riding on the basis of tonnage, and it had worked satisfactorily. No words could paint the difficulties of the local authorities with respect to extraordinary traffic claims. It was quite as difficult to formulate as it was to enforce claims. The author drew attention to the attitude generally adopted by canal and railway companies as to their failing to keep up the strength of bridges, the repair of which they were liable for. In the West Riding many bridges were closed to heavy traction engines owing to the prohibition which railways and canals put on the user of their bridges, and which they could do with great facility—indeed, as far as he could see, with absolute impunity. The only thing they could resort to by way of remedy was in the nature of arbitration, and in the past the results from this had been, to say the least, of very doubtful benefit. In regard to bridges to be erected, the county authorities had the remedy in their own hands, as by recent Railway Acts it was provided that the bridges should be of sufficient strength to carry the traffic of the district.

Mr. RATHBONE (Liverpool) had listened to the discussion with interest because the question had been for some time occupying his attention. They were always placed in the difficulty of being unable to find out exactly what was treated as extraordinary traffic in various districts. From the tone of the various speakers they were led to the conclusion that the Conference would desire some system of nationalisation of the main roads. Let them take the case of a heavy piece of machinery moved from the ship

at Liverpool to Preston. The load was 12, 14, or 15 tons per axle—not an uncommon weight; he had heard of a load of 50 tons per axle. When carried along the dock and main roads of Liverpool it would be rightly treated as ordinary traffic, but once in the country, on the macadam, the County Council would consider it extraordinary traffic. He had known instances which pressed very severely on manufacturers within a few miles of Liverpool, who had the worry of satisfying the road authority on the question whether theirs was extraordinary or ordinary traffic. If they had a more co-ordinated system of national roads, and some simple means by which manufacturers could ascertain what roads were suitable for their traffic, he thought it might go a long way towards remedying the existing grievance. In this matter England was not in the same position as Continental countries, where there were great rivers, while the canal system was not as available as they could wish it to be, and they were forced on to the use of the main roads for heavy traffic. If they had a national authority that could be applied to for information, he thought great assistance might be rendered to the trade of the country.

Mr. DRUMMOND (Renfrew) thought that with regard to the traffic in merchandise they had allowed too heavy weights to be carried, but a remedy might be provided by increasing the flange of the wheels. They should seek to get the Legislature to settle the weights of freights, wagons, etc.

Mr. GOWAN (Belfast) remarked that in Ireland, which he represented, they had no such thing as a law with regard to extraordinary traffic, and they got along fairly comfortably without it. He agreed with the last speaker that the condition of the law was anomalous with regard to any traffic not requiring special local authority. There should be regulations with respect to the weight per axle, wheels, and width of tyres, and he did not see why such a matter should not be fairly considered by the Conference. But, it might be asked, were the laws as to extraordinary traffic worth the trouble of maintaining? Could they be carried out and made workable? It seemed to him, after going into the question, that the game was not worth the candle.

Mr. HORTON (Derbyshire) was sorry it should be said that it was impossible to bring a successful action for extraordinary traffic. As regarded that point, one speaker answered himself by stating that he wanted to see the roads constructed for one class of particular traffic; but the point was that certain traffic was brought upon roads never intended for such traffic, and which ought not to be subjected to it. He thought it would be a great injustice if the ratepayers were put to the expense of providing for such traffic. If it were granted that some of the roads must suffer from the heavy weights taken over them, surely the individual who profited by such traffic was the person who ought to pay the damage. The question of extraordinary traffic was a vital one to highway authorities,

and if the position of the question was to be improved by passing a resolution he thought it would be desirable to pass one. He thought it would be a great boon if they had water carriage for extraordinary traffic. Why was it not available? Because, for obvious reasons, the railways had bought up the canals, and those waterways had become derelict. The bridges were very narrow. They were constructed a century back, long before the railways, and when the conditions of traffic were very different to what they were at the present day. The consequence was that nothing could be done to make the railways either widen or strengthen the bridges. The highway was narrowed to half its width at the bridges, some of which were absolutely dangerous. His Council were willing to contribute half the cost of building a new bridge, but the railway company would not provide the other moiety of the money for that purpose. Such a state of things was not just in any sense. There ought to be power to compel companies to make the bridges as wide as the highways, and it was highly important to highway authorities that their powers should be strengthened.

Mr. SHRAPNELL SMITH (Commercial Motor Users Association) said it was quite a misconception to suppose that the users of the vehicles were in a better position as regarded the law than the surveyors, for if they were taken into Court they had to fight against the resources of a public authority. He would be delighted to come to some arrangement with them, but they opened their mouth so wide that practically they banged the door in his face. A man was not in a position to know the condition of the road until he went several feet below the surface. How many surveyors could give the history of their roads and the foundations? He ventured to think it was unfortunate that such records did not exist.

Mr. COMPTON HALL (Lancashire) supported the remarks of the speaker who referred to the obstruction caused by railway and canal bridges, for that was a matter with which they were troubled in the county of Lancashire. They had several derelict canals, and no powers vested in the local authority to compel the railway companies, who had bought up the canals, to share in providing bridges adequate to the traffic. He believed the road authorities recognised that extraordinary traffic must be dealt with, and were willing to admit that this should be done on proper conditions.

Colonel LAND wished to point out that when powers were granted for the construction of railways the parliamentary committees thought it desirable and made it a condition that the canals whose traffic was interfered with should be purchased by the railway companies. These were the only conditions on which the lines were granted. There was an equitable side, therefore, to the question, and when it came to a question of reopening the canals the position of the companies required equitable consideration.

Mr. GRAFTON (Cheshire) said there was very little doubt in his mind, and of those who had experience of this traffic, that this was almost a more serious thing from the point of view of road maintenance than any traffic they had to deal with, not only because of its greater quantity, but also because of the peculiar conditions on which it was conducted. Under the Motor Act a diameter of wheel was permitted which experience showed was absurd, and it had a peculiar effect upon the road. The road was distorted more than worn out, and a great deal of the traffic was carried out under conditions which practically approximated to railway traffic. The strengthening of the roads up to the ability to bear such traffic was very serious in the matter of cost. In Cheshire they had one road whose cost of maintenance was three times greater than that of an ordinary road, caused entirely by extraordinary traffic. As far as he could make out, light motor traffic was going to be heavily taxed, while heavy motor traffic was going scot-free, which was a very serious thing. He was certain that the wheels were too small, and in future regulations preference should be given to vehicles of a larger diameter of wheel. To his thinking, the damage done by motor lorries was quite as serious as that done by traction engines. It was said that the local authorities had nothing to do but prosecute, but that was not quite so easy as it seemed to be. The difficulty was in weighing, and as a consequence they were forced to see weights which they were morally certain were greatly in excess of the regulations. They could only put down special weighing machines at such a cost that they would be cutting off their nose to spite their face.

Mr. SHUTTLEWORTH (Lancashire) stated that the annual expenditure on main roads in his county was £162,000, apart from bridges, an increase of £16,000 having been necessary entirely owing to the heavy motorcars.

Sir GEORGE RENSHAW (Renfrewshire) observed that in Scotland the question of extraordinary traffic had seriously affected the counties, and he was bound to say, looking at the matter from every point of view, that he believed there was a growing feeling that they had to recognise the fact that there was a complete change in the system of traffic on the high roads. The maintenance of the system of charging for extraordinary traffic was a doubtful factor with regard to the upkeep of the roads. There were large dairy centres in the county of Ayr from which milk was carried up to Glasgow. The earning capacity of the cars was something like £1 a journey, but the cost of the motorcars running over the roads to the county of Renfrew was something like £1,500 a year for each car. The hardship was an extraordinary one. They had no right to make a charge in respect of that traffic, but what they had to recognise was that if motor traffic of an excessive character was to continue some greater limitation should be placed upon the weights, and the wheels ought to be widened. Then there was the question of the repair of the bridges. He was.

sure the case of the canal bridge was more difficult than that of the railway bridge, because there were only slender earnings to meet any charges. In Scotland negotiations had taken place between the road authorities and the railway companies, and it was quite justly contended by the companies that the bridges were sufficient for the traffic at the time they acquired the canals. It was not the bridge but the traffic that had changed, and this made the matter essentially one for joint consideration between the county authorities and the railways. Fresh legislation, if necessary, should have for its aim a divided administration between the two authorities.

Mr. MORESBY WHITE said that if they defined extraordinary traffic as traffic which did damage to the surface of the highway beyond fair wear and tear, they had a perfectly good working definition. For this reason: An omnibus company was entitled to use the highway, and made money out of it, and theirs was only fair wear and tear, but if a man took a vehicle over the highway so as to damage it he was making an unfair use of a public property. He could be criminally punished for it because it was recognised he was injuring public property. Under the sections of the Highway Act they could prosecute any man who damaged or injured the surface of the highway. The only question was, could they prove their case? That, he knew, was the difficulty that always arose. It was only of late years, about 1875, that the idea came in that such a person must not only go to prison, but also pay in his pocket, and hence came the idea of a civil remedy in damages. It was with regard to machinery and the enforcing of damages that he spoke. He had no doubt in his own mind that the present system of enforcing the expense incurred for extraordinary traffic was altogether wrong. Let them take the procedure under the London Building Act. Questions of damage were settled by two experts and a legal man. So with the question of extraordinary damage to roads. What was wanted were two gentlemen who had a thorough knowledge of highway work, and who had a legal mind on the question of law and evidence. Make their decision final—he would not allow any appeal from it whatever—and let the certificate of the surveyor on the question of expense be as final and as conclusive as possible. That, he suggested, would be an effective tribunal to settle questions of extraordinary traffic.

Mr. DYKES (manager of one of the Lancashire canals) said they had had many bridges seriously injured during the last 15 years by heavy motorcars, which did more damage than traction engines. This should be borne in mind if they intended to assist in promoting legislation, on the argument of the Americanism, "Give the devil his due, but be careful you don't owe him too much."

Mr. SCHOFIELD (Lancashire) remarked that the uncertainty of the law action determined his county to charge a fixed sum per ton per mile, varying from 1d. to 5d. per ton,

to pass over paved roads as well as over the sands of the desert are constructed to meet both requirements, a bearing of some 3 in. projecting for the paving, with some 8 in. or 9 in. of spread for the sand.

There is, therefore, no reason to doubt that the altered conditions of traffic will have been satisfactorily dealt with in the course of the next few years.

In the meantime, motor vehicles destroy the existing roads, and the roads injure the present-day vehicles, so that a vicious circle exists which it is equally to the interests of road maker and road user to break by making both roads and vehicles more in accordance with their respective requirements.

Local authorities, and others, for some considerable time past have given minute attention to the formation and maintenance of carriageways, and at the same time the makers, and others interested in the use of self-propelled vehicles of all descriptions, have exercised their ingenuity in the design of cars best suited to the conditions of the roads to be traversed. A general desire, therefore, exists, as evidenced by the many conferences between road makers and users in different parts of the country, to act together, with the object of bringing about a set of conditions on both sides most advantageous to the common good, but there yet remains much to be accomplished.

It must also be said that the motor industry, and mechanical traction in general, have been a great incentive and help to better road construction.

In order to conduce to a discussion beyond that which took place at the first International Road Congress, held at Paris last October, it is desirable to quote the resolution arrived at upon the points concerned in this paper.

"EFFECTS OF THE ROADS UPON THE VEHICLES.

(From the "Surveyor and Municipal and County Engineer.")

"The Congress declares that it is to be remarked that no matter what point of view is taken, the following conclusion must always be arrived at: 'That when, for some cause or another, we find that the road has a detrimental influence on the automobile, so that the latter suffers therefrom, there is always a reciprocity, which results in the road itself suffering from this state of things.'

"In consequence one is led to the conclusion that if one suppresses everything which in the construction of the road tends to destroy the vehicles, these latter vehicles would not be capable of unduly or abnormally injuring the road, provided that they are constructed on lines and in limits compatible with the constitution of the roadway (actual or future) as regards the speed of such vehicles, the nature of their tyres, and their weight."

A. As regards the speed:

1. "The passage of rapid automobiles with pneumatic tyres produce on the surface of the road a dispersion of the small material of which the latter are composed, which dispersion or disintegration becomes accentuated according to the speed of such automobiles, and where macadam roads are concerned increases inversely with the lack of binding power of the said road, and in so far as the road fails to constitute a firm soil, well knit

together, and, therefore, proof against the production of much dust."

2. "All excessive acceleration of speed, whether caused by sudden starting or by the brusque and abrupt application of brakes, augments the damage to the roads to a considerable extent. The same remark applies, though in a less degree, to all change of speed of automobiles."

3. "In sudden turnings the action of the centrifugal force is added to the tangential strain due to the speed, and may thus considerably increase the damage to the road."

B. Regarding elastic or rigid bandages, with or without non-skidding apparatus :

1. "In the case of high-speed automobiles, it is necessary to reduce as much as possible the action exercised on the roads by pneumatic bandages, by the employment for tyres of a material which is as supple as possible, or, if the tyres must be armed, the steel rivets should in all cases be so rounded off as to present with regard to diameter the most moderate projection possible."

The views expressed in the several papers read at the Congress were very varied, and should be carefully studied. The author, however, is of opinion that the motor traffic is not so much to blame for the present condition of affairs as the road authorities, who in many ways have not taken advantage of the experience available for road construction.

Mr. W. J. Taylor, county surveyor of Hampshire, stated in his paper on "Wear and Tear of Roads" that one of the chief causes of the unusual damage arising from motor traffic is attributable to the defective design of the wheels, and the damage is increased where the wheel is the medium of motor power. Whilst giving credit to the great improvements in the construction of the wheel, as regards its stability, its power of resisting side strain and shock, and in the reduction of axle friction, he says no material has yet been discovered that will long resist the excessive wear and tear due to the influence of small wheels, high speed, and armoured tyres, combined with single-track running. This is undoubtedly a true grievance.

Mr. Douglas Mackenzie has stated, with facts and figures, that armoured tyres upon an asphalt surface has a most damaging effect. If the hardest surface we can hope to procure for roadwork is thus damaged, it is obvious that restrictions must be put upon the use of armoured tyres, or that they must be absolutely suppressed.

Several improvements for replacing armoured bands and for preventing skidding—such as the "Kempshall," the "Palmer" ribbed tyres, the "Goodrich" rubber-studded tyre—have lately come to the front and appear to be satisfactory. The tyres are made so as to present a rubber-surface ridge, projection, or stud to the road, the rubber being of a much harder nature than that previously used, giving the necessary adhesion and security against side slip.

One thing of vital importance is that all roads should be constructed and maintained with a view to reducing traction resistance, jar, and vibration to a minimum. In this way the upkeep of vehicles would be minimised and the roads would suffer less from undue wear and tear.

There is not the slightest doubt that a light car is the coming vehicle for all purposes, but before the weight of the car can be appreciably reduced the condition of the roads must be improved. A better road surface will render unnecessary the extra weight called for to resist the shocks of defective roadways. To obtain this and the most economical rolling contact between the wheel and the road, the skill of the two different people concerned is required.

With regard to increasing the diameter of the driving wheels, both Colonel R. E. Crompton and Mr. W. Taylor have called attention to General Morin's experimental researches made nearly 100 years ago, and Colonel Crompton went so far as to state that:

"It is probable their extra cost and weight will be far more than compensated for by the decreased wear and cost of upkeep of the vehicles themselves, and it is practically certain the damage to the roads will be reduced inversely as the diameter of the wheel is increased."

In and around towns where the roads have been more or less properly constructed, and where the speed is limited, the roads do not suffer to anything like the same extent as the main and other country roads do, for it is here that the weakest roads are met with and the highest speeds are attained. The advisability and needfulness of limiting the speed according to the size of the wheel and the weight of the car then becomes of serious moment.

With regard to the most injurious actions upon roads of the different rates of speed and of the great tractive or shearing force exerted by the driving wheels of motors, Mr. L. W. Page, director of the United States Office of Public Roads, and chairman of the United States Commission to the First International Roads Congress, states:

"For the purpose of studying this phenomenon I recently conducted a series of tests with motorcars of various shapes and sizes, from the 3,000-lb. Limousine to the small runabout. These cars were run at various rates of speed, and their effect studied on a section of average broken-stone road. The most interesting result was obtained with a 60-h.p. car stripped for racing. The wheels of this car were 36 in. in diameter, with 4-in. front tyres and 4½-in. rear tyres. The weight of the car with driver and mechanism was 2,800 lb. This car was driven over a section of broken-stone road at speeds varying from 5 miles an hour to 60 miles an hour, each run being increased at a rate of 5 miles an hour. The road used was a section of a Government road which had been resurfaced two years previous to the test, and was in very good condition. Up to 15 miles an hour little or no effect was produced on the road, and even at 20 miles an hour it was judged by those present that no serious damage was done. From 20 miles an hour on, however, the effect was markedly noticeable with each increase in speed. At a point on the road designated for the proper speeds, photographers, with the necessary high-speed cameras, were stationed for the purpose of taking photographs from different points of view of the effect produced.

"The chief point of interest in these photographs is the difference in effect on the road between the front and rear wheels. Now, if it is true, as has been claimed, that a vacuum is formed in the rear of the pneumatic tyres, or that it possesses any power of suction, this should be equally true of both front and rear wheels.

I am convinced, after much observation, that this is not the case, and I think this point is illustrated by the photographs.

"To sum the matter up briefly, the pneumatic tyre, or any type of tyre which propels a vehicle, must have sufficient tractive resistance to overcome the load of the vehicle. This of necessity must cause a shear on the road surface, which varies with the weight and speed of the vehicle."

It is obvious, therefore, from the experience now gained of the effect of wheels upon roads, that measures must be taken to reduce it to a minimum, and the author suggests that rules should be made regulating the width and diameter of wheels, the weight of the cars, and the maximum speed to be attained upon public roads upon this basis. The author does not think it is within the province of the paper to suggest the rules, as it is entirely a matter for discussion in conference between the interested parties.

IDENTIFICATION MARKS.

Parliament has given the Local Government Board power to make regulations "providing generally for facilitating the identification of motorcars, and in particular for determining and regulating generally the size, shape, and character of the identifying marks to be fixed under this Act, and the mode in which they are to be fixed, and to be rendered easily distinguishable, whether by night or by day."

It appears to the author that legislation has provided all that is necessary in this matter, but he is of opinion that the Local Government Board should enforce their Article XI., so as to secure better illumination of the identification plate at night.

PENALTIES AND THEIR DISPOSAL.

The author is of opinion that all penalties and fees whatsoever in connection with motorcars should be paid into the county exchequers, after deducting the costs incurred in prosecutions, etc., for the maintenance and improvement only of the main roads and roads contributory thereto. This would be the most equitable procedure so far as the mutual interests of the car and of the road are concerned.

PAPER 37: BY J. H. GARRETT, COUNTY SURVEYOR OF MAIN ROADS AND BRIDGES, WORCESTERSHIRE.

In consequence of the introduction of heavy and light motorcars, traffic on the roads has greatly changed and increased during the last few years, and there is no doubt but that these self-propelled vehicles will continue to increase in number and variety.

The users of ordinary vehicles, and the public generally, have to a great extent been deprived of the enjoyment and free and safe use of the roads by the high speed at which light motors travel, and the dust they cause, which is not only a nuisance to persons on the roads, but to people whose residences are near the roads, and gardens and crops contiguous thereto are damaged by the dust settling upon them, so that there has been much complaint of the consequent depreciation of the value of such properties.

The matter is aggravated by the fact that motorists, and those

interested in them, form only a small proportion of the population, and of the ratepayers generally, who have to bear the increased cost of maintaining the roads.

The altered conditions will no doubt be provided for in time, and the author's object in writing this paper is to submit for consideration a few practical suggestions in that direction.

Previous to the advent of motorcars the main roads had generally been much improved in condition by the County Councils, and answered well for the old traffic, but for the new traffic they are in several respects found to be deficient and unsuitable. This applies more to light motors than to heavy ones, as the former are more numerous, travel very much faster, and far greater distances. Owing to the greatly increased number of vehicles, the heavier loads carried, and the higher speeds at which motorcars travel, roads require to be made stronger and wider, sharp bends and corners want rounding off so that collisions may be avoided, and some new material for binding road surfaces, so as to reduce dust, is much needed.

The wheels of all self-propelled vehicles, as compared with horse-drawn vehicles, are far more destructive to roads owing to the grip they have on the surfaces, and the bars, studs, and other contrivances with which they are fitted for securing that grip. Heavy motors are becoming very numerous, and are carrying heavy goods for long distances over the roads which were formerly conveyed by rail; but they travel at a reasonable speed, and do not much exceed the dimensions of horse-drawn vehicles. They, therefore, are less objectionable than the ponderous traction engines and trucks, which are a nuisance to general traffic owing to their size and weight, and causing, as they do, abnormal damage to rural roads and bridges. They benefit comparatively few people; the expense which road authorities often have to incur in consequence of their use is vastly in excess of any saving effected in the cost of hauling; and much trouble and litigation has been brought about owing to the great damage caused by traction-engine traffic.

It would be an immense advantage to roads and bridges, and a saving in the cost of maintaining same, if the maximum weights of locomotives, including their loads, water, fuel, etc., and of loaded wagons on four wheels, were limited to 10 tons; and an increased width of tyre in proportion to axle weight would also be an advantage both to the roads and the drawing power of the engines.

Light motors, owing to their speed and the dust they cause, are mainly responsible for the altered conditions of traffic upon the roads, and, considering that they are allowed to use the roads in common with all other kinds of public traffic, it is unreasonable that they should be permitted to travel at such high speeds, and the maximum limit of 20 miles an hour should be enforced. If such a rule were insisted upon, there would be less danger to motorists themselves and to the general users of the road. The lower speed would also reduce the dust nuisance and cost of road maintenance.

It would, in the author's opinion, be unwise to adopt any other speed limit in towns or elsewhere, as it would only lead to complications without diminishing danger. The speed should be regulated according to the nature of the street and the traffic upon

it at the time. For instance, it may be safer to drive along a street at 20 miles an hour at one time in the day than 8 miles at another, or at similar speeds along one road than another in the same district.

A great deal might be done by the police in towns to regulate speed by their raising one hand, which drivers should take as a direction to proceed at a slower pace, and both hands as an order to stop.

It is the common practice of motorists to drive too fast, and to the danger of the public, round bends and corners and along narrow and tortuous highways. An occurrence in this neighbourhood may be mentioned as an example. A few months ago a gentleman's carriage while turning into his carriage drive from the main road, which has a rather sharp curve at the point, was run into by a motor. Now this was a clear case that the driver of the motor was driving to the danger of the public, as he was unable to pull up in time to avoid the collision, and, therefore, was liable to prosecution under the first section of the Motorcar Act, 1903.

Motorists would no doubt strongly object to the author's proposals, but the general public are entitled to a fair share of consideration, and their rights and safety must be safeguarded.

The rule of the road, except at important junctions of streets in large towns where enforced by the police, is sadly neglected, and collisions at corners usually occur through its non-observance. Drivers generally take the inner side of the curve, although they cannot see any approaching vehicle which they may be about to meet; whereas if two vehicles meeting at a corner keep to their respective proper sides, however fast they may be travelling and provided the road is of sufficient width for them to pass each other, they would not collide.

One sometimes hears complaints that motorists make too frequent use of the horn, but the reverse is the fact with many drivers. The discordant sounds are not pleasant to the ear, and it is hoped that some more musical contrivance will come into use before long; but the safety of persons using the roads is of the greater importance. Drivers when approaching villages, cross-roads, junction of roads, and curves, beyond which they cannot see what traffic or hindrance may be in their way, should sound the horn, and so slacken speed as to be able to pull up quickly. The horn should also be sounded when overtaking another vehicle, the driver of which may otherwise be unaware of the approaching motor. This will also apply to cyclists, who should always sound the bell when overtaking any vehicle, cyclist, or pedestrian.

Opinions vary much regarding the utility of danger signals. In the author's opinion it is a mistake to erect such signals at any but really dangerous points, and where drivers who are strangers to the locality cannot otherwise be aware of danger as if too numerous the signals are disregarded. They are not necessary at approaches to cross-roads or junctions of roads where proper direction posts are conspicuous, nor at the tops of steep inclines, or the vicinity of sharp bends, or at the entrances to villages or towns, because all these conditions are clearly visible to every intelligent driver or cyclist, and he ought to drive slowly and cautiously at such points.

Pedestrians often complain of the danger they are subject to

owing to motor traffic, but when persons are run over or knocked down by motors, more often than not it is the fault of the pedestrian rather than the driver of the motor.

Where footways exist by the sides of streets or roads persons on foot should make use of them as much as possible, or otherwise keep to one side of the road, and should accustom themselves always to look in both directions before attempting to step off the footpath or cross the road so as to be sure of not getting in the way of approaching motors or bicycles. The above will apply especially to aged and deaf persons and children.

It is a common custom for children when leaving schools, their homes, and by-streets and alleys, to rush into the main thoroughfares regardless of motors or other vehicles which may be passing, thereby often placing themselves in great danger.

It would be most useful if children were frequently warned in schools of the danger they place themselves in by this practice, and were requested to keep to the footways instead of running into the carriageways without necessity.

PAPER 38: BY REES JEFFREYS, SECRETARY TO THE MOTOR UNION AND THE ROADS IMPROVEMENT ASSOCIATION.

The Acts governing motor traffic provide that ordinary pleasure motorcars must not be driven at a greater speed than 20 miles per hour, and give powers to the Local Government Board to impose reduced speed limits in certain places when they are necessary for the safety of the public.

It may be taken, however, that there is not a driver of a motorcar who does not habitually exceed the present maximum speed limit of 20 miles per hour on the open road, when he can do so without danger or annoyance to the public.

The speed limit is in principle a wrong form of regulating traffic. It directs attention to the speed, which is quite a secondary consideration in traffic regulation. The important factors are control, consideration, and judgment.

A speed limit is unjust in operation, as it leaves the motorcar driver at the mercy of the timing arrangements of the police, often crude, and dependent entirely upon the skill and honesty of the policeman and the correctness of his watch. It is not an effective means of enabling the authorities to deal with that minority of motorists who drive in a reckless manner without due regard to the rules and courtesies of the road. In counties where the speed limit has not been strictly enforced—viz., Bedfordshire, Leicestershire, and Nottinghamshire, all of which carry a considerable amount of motorcar traffic—there has been less trouble and fewer complaints in regard to motorcar driving than in counties like Sussex or Surrey, where the police enforce in certain places the strict letter of the Act, quite independent of the surrounding circumstances.

Much of the apprehension of the public as regards the safety of motorcars and the belief in the efficiency of the speed limit is due to the confusion that exists in the minds of not only the man in the street but also of some public officials as to the distinction between *average* and *maximum* speeds. It may be taken approximately that a *maximum* speed of 20 miles per hour means an

average speed of 14 miles per hour on a low-powered car and 17 on a powerful car. A driver who accelerates his speed to 21 miles an hour for even 50 yards is guilty of an offence.

The principal arguments against speed limits generally and the methods of enforcing them are briefly enumerated below :

1. The speed limit has not prevented fast and inconsiderate driving through villages, as, in the main, speed limits have been enforced on the straight and open country roads, where there has been no element of danger, and not enforced through villages, round corners, or places where danger exists. The inconsiderate driver knows that in these places he is safe from prosecution, and makes up in the villages the time he loses in evading police traps on the open road.

2. The victims of speed limit prosecutions are largely the considerate drivers, and not the reckless and inconsiderate drivers. Considerate drivers are always anxious and willing to assist the authorities in repressing the inconsiderate driver, but while the former is treated as a lawbreaker this co-operation is impossible. If every motorist passing through Sussex and Surrey feels that he is regarded by every policeman as "an uncaught criminal," the result cannot be anything but disastrous.

3. Speed limits bring the law into disrespect and contempt, as they can only be enforced in an arbitrary and uncertain manner. They have made local justice in certain districts a by-word owing to the police traps being set for no other purpose than to raise local revenue.

The effect of the abolition of the speed limit would be to raise considerable alarm amongst those members of the public who are opposed to motorcar traffic. It would be urged that the abolition of the speed limit would license and invite drivers of motorcars to drive high-powered cars at speeds of 60 miles per hour and upwards upon public roads. The fact that with the abolition of the speed limit the provisions with regard to driving at a speed dangerous to the public would still be operative, and would be more strictly enforced, is quite ignored. Many of the road authorities would probably oppose the abolition, not on the ground of the safety of the public, but on the ground that speeds between 30 and 60 miles per hour are exceedingly destructive of the surface of the roads, and that the amount of wear and tear done by high-powered cars going at very high speeds is quite out of proportion to the advantages gained by the individual user.

Motoring opinion is unanimous that the present law with regard to the speed limit should be altered. As regards the form that the alteration should take there are two opinions ; one favours the abolition of the speed limit altogether and the other favours the retention of the speed limit, but increasing it in the open country to 30 or 35 miles an hour, and reducing it in villages and small towns to 15 miles an hour. Ten miles an hour is an unreasonable and, in practice, an impossible limit.

Those who ask for the total abolition of the speed limit argue that for the reasons already stated speed limits are a wrong method of regulating traffic. It is a "quack" remedy, which, in the long run, must give way to something better.

Those who advocate the second course recommend it from the point of view of political expediency. They think that even from the point of view of motorists themselves the time is not ripe for the

abolition of the speed limit altogether, although it is a bad method of regulating traffic. They point out that in the unsettled state of the public mind with regard to motorism, the abolition of the speed limit would mean that in any district disturbed by motorcar traffic the pressure brought upon the police to "do something" would result in drivers being prosecuted for driving in a manner dangerous to the public. *Convictions would inevitably follow, and the unfortunate motorcar driver would be branded as a dangerous driver.* If a reasonable speed limit existed the police would only take proceedings under that section, and the convictions, although attended with inconveniences and penalties, would carry little or no moral stigma.

There is much to be said from both points of view, but the latter, namely, the imposition of a maximum speed limit of from 30 to 35 miles an hour in the open country, might gain the support of those road authorities who believe that speeds in excess of 40 miles an hour damage the public roads to an extent which outweighs the advantage to the private individual who finds it a source of pleasure or of convenience to drive at these speeds.

It should, however, be borne in mind with regard to the latter contention that, although there is wear and tear of the roads at high speeds, there is even a greater wear and tear on the tyres of the motorcar. High speeds carry their own corrective, as the average motorist, for pocket reasons, finds himself unable to indulge in them.

DISCUSSION.

Sir E. VERNEY said that Mr. Garrett in his paper had advocated the enforcement of a 20-mile speed limit, and said "the general public are entitled to a fair share of consideration, and their rights and safety must be safeguarded." He should think they were so entitled. They were entitled to a great deal more consideration than they got at present, and he gathered that that was the opinion held by Mr. Garrett himself. When they looked at the complaints, they resolved themselves into a very small number. The chief complaint was the danger to the public arising from great speed; the next was the injury done to health and to agriculture and gardening by dust. Mr. Chambers in one respect had told them something which was really more to the point than anything that came before them when he stated that "up to 15 miles an hour little or no effect was produced on the road, and even at 20 miles an hour it was judged by those present that no serious damage was done." So really all the complaints resolved themselves into a question of speed. Mr. Jeffreys took the opposite line. He said the speed limit was wrong in principle. The important factors, he said, were control, consideration, and judgment; so if there was plenty of that they must not complain if they

were frightened out of their wits, and some of them run over. Mr. Jeffreys said that 10 miles an hour was an unreasonable and, in practice, an impossible limit. If they wanted to see that in full force they had only to go to Hyde Park, where nobody was allowed to go more than 10 miles, and they did not think it unreasonable or impossible there. He had said that in certain districts police traps were set for no other purpose than to raise local revenue. He (Sir E. Verney) hoped that Mr. Lloyd George would take notice of that, for he wanted revenue, and there was his opportunity. All the three papers dealt with the evil, but not one of them suggested a remedy. If they wanted to get rid of this nuisance, they must do it through the penalty. Fines were paid, and the defendants went away and did the same thing again. This was the only instance he knew of where people who broke the law were rather proud of it. Rich people were constantly in the habit of breaking the law, but they wrapped it up. They had people who broke the law intentionally, and who bought a motor specially for the purpose. He thought the car should be detained by the police for at least a week, which was not more than the offence deserved.

Mr. WOOD HOMER (Central Chamber of Agriculture) agreed that this was a question which resolved itself into a question of speed, and that the chief consideration was due to the public. There was a Bill to be brought before Parliament by Lord Willoughby de Broke which would enable motorcars to go at 30 miles an hour. He hoped that would be opposed by the public. There would be danger to public life and property, and there was the wear and tear of the roads caused by this fast speed. It had been well put before them that 15 to 20 miles an hour did not much injure the roads, but when a great pace was put on the roads went to pieces. He hoped the law would be continued which allowed a maximum speed of 20 miles. The putting up of danger signals at the present moment was a perfect farce, for the driver came along sounding his horn and went on running at the same pace. Every local authority should have the right to put up a danger signal mark on the different sides, and then the speed must be reduced to a maximum of 10 miles an hour within the danger zone; the local authority should have the right to put them up, subject only to appeal to the Local Government Board. It should be a competent surveyor employed by the Local Government Board. On the question of penalties he did not quite agree that the forfeiture of a motorcar for a week would be a great penalty. The penalty should be on the persons riding in the car if they were the owners of it, and it should be doubled every time. He thought there was a noble lord who had already run up to about half a million.

Mr. R. LAMBIE (Lanark County Council) said the last two speakers had gone in for a speed limit in the interest of the public, but his position was that they should have no speed

limit, and he said that deliberately. Ten miles an hour would be far too much. As to furious driving, why should there be a distinction drawn between ordinary horse traffic and motorcar traffic. Whatever might be said, motors were here to stay, and it was for the motor authorities and the public and those who were controlling the traffic to see that the public was properly protected. He would have it seen to that drivers of motorcars were thoroughly competent. A man might be a very competent driver with a car at 10 or 15 miles an hour speed, but he might be of no use at a higher speed. They should all be licensed, no matter whether it was a lord or duke. If they went on the lines he indicated the danger would be minimised, and the community would be protected in a way that they could not be at the present time. Local authorities should demand that every man who took a car in hand should be a competent man and tested on the different speeds, and that would be of more effect than a speed limit. Instead of directing their attention to speed limits, they should direct it to the point of competent drivers. Then with regard to dust, it was there, and the authorities were beginning to grapple with the question, and also with road-making. Instead of local authorities trying to stifle the motor traffic, they should encourage it and consider how they could minimise the dust without a speed limit, which would regulate itself, and the community would be protected if the parties were taken up for furious driving. A 10-mile limit in the parks was ridiculous, because it was said that there was no danger under 10 miles. When a man was taken up for furious driving of a motorcar he ought to be given the penalty of being sent to prison, which would be much better than a monetary penalty and the confiscation of the car.

Mr. C. T. G. TICKLER (Grimsby) entirely agreed with the last speaker with regard to the speed limit of motorcars. He thought there was no necessity for a speed limit, and the authorities had quite sufficient power if they exercised the power vested in them now by prosecuting anyone for reckless driving. There was much to be said in favour of everyone who was a licensed driver of a motorcar being fully qualified. At the present time anyone could go to a police station and get a driver's licence no matter whether he could drive a car or not. The law should be such that everyone who wished to drive a motorcar should satisfy the authorities that he was a competent driver and capable of driving to the safety of the public. The road authorities should be called upon to do something in the direction of preventing the dust nuisance. The motor driver paid his rates and all dues and payments, and he had a perfect right to use the roads as much as anybody else who drove, and he should have something done for him in that respect. He had no doubt that something would be done in the near future to prevent the dust nuisance. With regard to danger signals being put up by local authorities, he believed they were provided at the

present time by the Motor Union, and that the local authorities placed them in the position which they thought most necessary. But there was one important matter which they neglected to do, and that was the illumination of the danger signals at night. People could not see the danger signals at night, and the local authorities ought to be required to do this. He did not think there was much more danger in driving 30 miles an hour than 10 miles. They saw many taxi-cabs going at quite 20 miles an hour in a city like this, and yet people said it was too fast to go in the country, where there were so many straight stretches. Everyone who drove should be responsible for his actions, and the penalty should occur if it was proved that he had driven recklessly. Even eight or ten miles an hour was too quick in going round corners, but in certain open places 30 miles an hour was not fast. There was less danger in 30 miles an hour on a straight road than eight miles round a corner, and for that reason he thought a speed limit unnecessary. Drivers ought to be required to pass some examination before the authorities granting the licence gave it to them.

Mr. BALLANTINE (East Stirlingshire) agreed that licensed drivers should all be competent. It was excessive speed that caused danger. Where motorcars drove cautiously and moderately they did no damage to the roads; it was the excessive speed that did it. His opinion was that if the law was observed as it at present existed there would be very little difficulty. They had the 10-mile limit in Stirlingshire through all their towns and villages. The driver raised very little dust and caused very little inconvenience to anyone, and as soon as he was out of the town he could go at 20 miles. There was no reason why that should not be the same in other places, and there would be no cause of complaint. Motorists might help the County Councils greatly in this matter. In Scotland they acknowledged that the motorcar had come to stay, and they did everything possible to make the roads better. They were broadening them out where they had the ground to be utilised for that purpose, in order to give greater space for traffic, and they were getting the best material possible for the surface. There was no need for a breakneck speed of 40 or 50 miles an hour, and if motorists would go moderately things would be all right. Road surveyors and motorists should come more into touch with each other, with the object of securing better roads and using them rightly. Their authorities were required to put up danger posts under the Act, and though some motorists might not observe it, the County Councils must fulfil their obligations.

Mr. BUTTEMER (Royal Automobile Club) remarked that there were one or two points in the papers that had not been referred to. It would be very unfortunate if the question they were considering were made into one between the rich and the poor. It was, in fact, no

such thing. It must be remembered that at the present time there were many medical and other professional men using motors, and also that motor vans and others came under the head of light motors. The whole population was interested in the matter. As to danger signals, most motorists drove with consideration and care, and the few who exceeded the limit were not caught by exceeding 20 miles an hour. It was quite possible and probable that cars would become lighter. As it was, they were heavier than they ought to be, and if they should become lighter and be encouraged a good thing would be accomplished. He doubted if at present the suppression of armoured tyres would be practicable. It was, at any rate, only the heavier and faster cars that did damage to the roads, and only on hills or sharp turns where it was done. It was the amount rather than the nature of the traffic which was the cause of the roads getting into such a bad state in these days. There was the difficulty of persuading the public that it would pay to adopt costlier roads. Much of the light traffic, also, was really heavy—they were loaded up to a great extent, and they were responsible for a large amount of damage. Goods traffic in light cars produced much effect on the roads compared with the average car. As regarded the 10-mile limit, it was in very few places where that limit was observed even while the non-motoring spectator believed it was. They saw drivers going with caution, and they did not realise that the cautious driver was going perhaps 14 miles an hour without the least danger. The only way he could suggest that the inconsiderate driver should be caught was something in the nature of a general observation of drivers being made, and anybody who had been seen driving to an excessive extent should have a mark made against him by some authority set to watch, and if a man got two black marks accumulated in different parts of the country it should be admissible as evidence against him if he caused any accident on the road. Some persons might drive occasionally too fast through absence of mind, but the man they wanted to suppress was the man who went down streets and round corners in a reckless way. That seemed the only way to wipe out reckless drivers.

Mr. H. H. COPNALL (Notts) stated that his County Council had not enforced the speed limit, and he did not think they were ever likely to do so, except where excessive speed was really in the nature of dangerous driving and cars going recklessly through populous places. But on roads where cars might run along for many miles without meeting anybody or doing damage, it seemed strange to say that they should be entitled to go 19½ miles an hour, but would be committing a great offence if they went 20½. With regard to police traps, the impression in his Council was that in some cases they were for the purpose of obtaining revenue for local rates. He thought that was a wrong principle to go on altogether. Punish a man if he was doing wrong, by all

means, but it became persecution if they simply proceeded against men for the purpose of obtaining revenue. Then there was the uncertainty of the law at the present as to whether a man could be convicted on the same evidence for exceeding the speed limit and also for driving dangerously. There was a case in the King's Bench the other day where the question came up before the Lord Chief Justice and two other judges, and they were unanimously of opinion that there was nothing to prevent a man being convicted for both offences, and the judges practically said that if a case came up in another form there was no doubt the former decision would be reversed. The only way now to get an endorsement of the licence was to proceed against a man in the first instance for driving dangerously, and in his opinion dangerous driving was an offence that ought to be punished; that was the offence which at the first time brought about an endorsement of the licence, and it was the endorsement of the licence which had a salutary effect upon the dangerous driver. They had to consider whether a 10-mile limit or a 12-mile limit met the difficulty. If they imposed a limit of that kind, was it not giving latitude to the dangerous driver? ("No.") If a man was driving six or eight miles an hour round corners near Trent Bridge he was driving dangerously, and the law was quite sufficient to deal with him. In the same suburb they got long streets and wide roads where there was practically no danger at all, and there was no reason why the limit should be reduced. A man could drive 15 miles there without danger on ordinary days. What was the use of the 10-mile limit? Punishing the man for driving dangerously was the real remedy. If discretion were exercised in putting up danger signal at points of real danger, it would have more effect and be more likely to be taken notice of than if they were put up all over the place. His Council had put up very few, and only at the most dangerous places. He regarded the suggestion of illuminating danger signals at night as absolutely impossible. There was a good deal theoretically to be said in favour of some examination of drivers, but he did not quite see how it was going to be carried out. There was a suggestion in one of the papers to be considered later which would go a long way towards getting rid of the reckless driver, and that was by greatly increasing the fee of the driver's licence.

Sir A. B. HEPBURN (County Councils Association of Scotland) said he spoke more as convener of the county of Haddingtonshire. In Scotland they had not the inducement which there was in England to lay traps and prosecute motorists with a view to getting fines to assist the local rates for the roads. In Scotland, unfortunately, those fines did not go to the county at all, but for Imperial purposes. The Standing Joint Committee had instructed the police, who were under them, that they were not to pay much attention upon ordinary stretches of roads where there was no danger, and where it was natural that the speed might be exceeded.

But they were told to pay special attention to dangerous spots and corners. Signals were only put up at places which were very dangerous, and more notice was then taken of them.

Lord MONTAGU (Royal Automobile Club) said he was a member of the Highways Committee of the Hampshire County Council, which dealt with several hundred miles of main roads, and had to consider all the problems arising from road wear and tear. As regarded danger signals, their policy was to put up as few as possible, because by putting up too many they created in the minds of motorists a false security as regarded places where they were not put up. In Lord Willoughby de Broke's Bill he adopted a principle as regarded speed which might well be considered by this Conference—the principle of zones—and he allowed a speed of 30 miles to be attained on open roads. What they wanted was not a hard-and-fast limit, but as elastic a law as possible.

Sir HICKMAN BACON (Lindsey, Lincolnshire) thought there were very few people who were really competent to judge of speed unless they were in the habit of travelling with a good speed indicator. He agreed with Mr. Jeffreys, but although he would like a complete abolition of the speed limit, he did not think at the present time it would be politic to ask for that. It occurred to him that if the speed limit on the open road was increased to about 30 miles an hour, and in villages and towns reduced to 15, that would be a fair compromise and would meet all ordinary requirements. In very narrow villages and towns where there was much traffic, of course 10 miles an hour might be too fast. He not think that any speed limit was of the smallest use in promoting safety with regard to road management. From information collected during the last few years it seemed impossible to deny that speed and weight together did undoubtedly cause considerable road wear, not only on the surface, but had a crushing effect on the foundations underneath. In his county they had consulted the Automobile Club as to danger signals, and had agreed to put them up at places recommended by the club.

Mr. ROWLATT (Leicestershire) said that, as regarded the question of the pace through villages and the speed limit, his Council held that they did not want a limit, and if there was driving to the common danger there was an end of it. Their view was that there ought not to be a 10-mile speed in villages, and that it was a dangerous thing to have that speed. They were of opinion that the general law in regard to driving to the common danger was sufficient for the purpose of punishment. Motorcars did not destroy the roads in the towns, but they did in the country when going at a high rate of speed. It seemed to him that if they could get along fairly with a tyre that did not injure the roads, they ought to prohibit the tyres that did.

Mr. H. STURMEY (Coventry), alluding to Lord Willoughby

de Broke's Bill allowing a limit of 30 miles, said the limit of 10 miles an hour in towns and villages seemed absurd, because the majority of villages were deserted, especially during the greater part of the day. Within certain limits both of weight and speed, he did not think motorcars did any more damage to the roads than bicycles did, but when they came to heavy vehicular traffic no doubt damage occurred, and the greatest damage done was at corners. Police investigators should be placed at these corners rather than be told to watch in the open roads. What they wanted, as regarded wear and tear, was improved construction of the roads themselves.

Mr. REES JEFFREYS, in reply, repeated that speed limits, in principle, were an absolutely wrong method of regulating motorcar traffic. They diverted the driver's attention from what should be the dominating features of his mind—to drive with due regard to the condition of the road and the traffic upon it at the time he is passing over it. To substitute for these dominating principles observance to a mechanical speed limit, which does not vary with varying conditions, was a mistake. He agreed there was little hope of the immediate abolition of the speed limit, but it should be made more elastic. He had taken part in all speed limit inquiries that had been held in England and Wales since the passing of the Motorcar Act, which enabled the local authorities to apply for reduced speed limits in their districts. He found that very mistaken ideas prevailed among local authorities as to the conditions under which motorcars were driven. The authorities who were the most anxious for the speed limits to be imposed had not a single practical motorist among their members. Ten miles an hour was an absurd and impossible maximum even for a busy town. He would like to take this opportunity of dealing with the signs that were erected where reduced speed limits had been granted. They were most inadequate. The present sign served its purpose in quiet villages on country roads like Colsterworth, where it stood out against the landscape and attracted the attention of drivers, whose attention was not diverted by other traffic. In more populous places, however, such as Bromley, Kingston, Watford, Brentford, Ilford, St. Albans, Haslemere, Farnham, and Croydon, the circumstances were very different. In these places the attention of the driver is properly concentrated upon the road and the traffic immediately in front of him, and it does not conduce to the safety of the public if he has to be continuously scanning the pavements to see if a 10-mile limit sign has been erected. Under these circumstances the majority of drivers feel that their first duty is to secure the proper driving of their cars, and it is no exaggeration to say that in over 50 per cent. of the cases in which motorists have been prosecuted for exceeding the 10-mile speed limit they were unaware that a reduced speed limit existed on the particular road on which the alleged offence was committed. It is essential, therefore, in the interests both of the local

authorities, who wish the limit observed, and of motorists themselves, who would not deliberately ignore the limit, that the sign to indicate that a reduced speed limit is in operation should be a continuous one. A single notice at the beginning of the limit, however prominent, is liable to be obscured by a stationary vehicle. He, therefore, put forward the two following suggestions, which, if adopted, would, at no great cost, give adequate notice of reduced speed limits: (1) that a red band, 18 in. in depth, shall be painted on the stem of every public lamp post or electric light standard in the speed limit area; or, alternatively, (2) that a red tablet, 8 in. by 3 in., shall be attached to the arm which usually projects at right angles from the lamp standard, and should bear the words, "Ten-mile speed limit for motorcars." (Notices of this type are frequently to be found in London to indicate the position of public baths and fire alarms.) Either of these suggestions, if adopted, would have a further advantage of being visible to motorists driving at night.

SECTION B.

HEAVY MOTORS (SPEED, WEIGHT, ETC.), TRACTION ENGINES.

CHAIRMAN :

A. H. SCOTT, M.P.

SECRETARY :

RICHARD BROMLEY.

TECHNICAL SECRETARY :

W. REES JEFFREYS.

Papers 32, 33, and 34 were taken as read, as follows :

PAPER 32 : BY H. HAMPTON COPNALL, CLERK TO THE NOTTS
COUNTY COUNCIL.

The fact that the cost to the ratepayers of the maintenance and repair of roads has largely increased of late years, is attributable to a great extent to the use of traction engines and heavy motorcars on the roads for the haulage of heavy traffic.

With certain exceptions—viz., agricultural locomotives and steam-rollers—every traction engine has to have a licence from the council of the county in which it is ordinarily used. The minimum charge for the licence is not to exceed £10 per annum. Additional licences may be obtained in other counties, and for an additional licence there is a minimum charge fixed, not exceeding £5 per annum. If an additional licence be not obtained, a traction engine can only be used on the highways in any county in which it is not licensed by payment of 2s. 6d. per day. Drivers are not licensed.

Agricultural locomotives and steam-rollers are registered, the registration fee not exceeding 2s. 6d.

Heavy motorcars do not require to be licensed. They must be registered, and the registration fee is 20s. Annual renewal of registration is not required. Drivers of heavy motorcars are required to be licensed, the licence fee being 5s. Heavy motorcars, properly inscribed with the owner's name and address, and used solely for the conveyance of goods, or of instruments of trade or husbandry, come within the scope of the exemption from carriage licence duty conferred in favour of trade carts.

It is obvious, therefore, that, even where full fees are charged, the income derived from traction engines and heavy motorcars using the highways is of very small amount, and bears no comparison to the cost the ratepayers have to bear in consequence

of such traffic. In some counties the full fees (small as they are) are not charged.

There is no power in any of the statutes relating to traction engines and heavy motorcars enabling a road authority to restrict heavy traffic on the roads. There is nothing to prevent a traction engine or heavy motorcar going over and damaging a road immediately after the break up of a frost, or just after the road has been repaired.

Occasionally the traffic is of the nature of extraordinary traffic, but generally it is ordinary traffic only; and it is from the point of view of the use of the roads for ordinary traffic that this paper is written.

If the heavy traffic carried from place to place by traction engines and heavy motorcars was carried by railway, railway rates would have to be paid for the use of the railway. The question naturally arises, why the roads, repaired at the cost of a particular set of ratepayers, should be used and damaged, and no contribution made to the road authority in respect thereof, by the person for whose benefit the traffic is conducted. Generally speaking, this person is not a ratepayer nor even a licence holder in the particular county, but is the user of an "unlicensed locomotive," for which he is paying a fee of 2s. 6d. per day, while he is damaging the roads to the tune of tens, if not hundreds, of pounds. For instance, much heavy traction-engine traffic is carried on by proprietors of steam roundabouts, etc., and travelling showmen who travel all over the country.

Thousands of miles of road in this country are weak in construction. Such roads were and are quite sufficient for ordinary vehicular traffic, but they were never intended for the heavy traffic they are now called upon to bear. The contention of the users of traction engines, etc., is that the roads should be so constructed as to carry the traffic. The cost of this would be enormous. Who is to bear the burden of it? The ratepayers, or the persons for whose benefit the traffic is conducted?

In the old days of turnpikes the burden of road repair was upon those who used the roads. There was much to be said against the turnpike system, but it had many good features, and might work advantageously to the road authority if it were in force at the present time. But turnpikes cannot be revived—some other remedy must be found.

A tonnage rate would meet the difficulty, and it is believed it could be effectively worked. A declaration could be required as to the tonnage of certain traffic to be conveyed from place to place, and a rate or charge paid in respect of such tonnage. A certificate that the necessary rates or charges had been paid in respect of the load could be carried by the driver of the traction engine or heavy motorcar, and it would operate as a wayleave. Details of such a system would have to be carefully thought out; but there appears to be no reason why such a system should not work as smoothly as the system in force in regard to transit by railway. From a contractor's point of view it may be urged that a tonnage rate would be an advantage to him, because it would enable him in tendering to estimate with some accuracy the sum he would have to pay for road traffic. At present he always has a fear of a possible claim in respect of extraordinary traffic, and to provide against this he inserts a lump sum in the tender to cover

any such claim. This sum is guessed, and may or may not be sufficient.

Another remedy would be the deposit of a sum to cover damage done.

In the Bury Improvement Act, 1885, there is the following section :

" 77 (2). The Corporation may require any person who desires to use a traction engine in any street to deposit with them such sum of money not exceeding £100, as they may deem reasonable, to recoup them the cost of repairing any damage which may be caused to any street by any such engine passing along or over the same respectively, and in case of any such damage they may repair the same and apply such deposit to meet, as far as it will extend, the balance of such cost from such person, and so from time to time.

" 77 (3). If the Corporation require any person to make such deposit, they shall pay interest to such person after the rate of £3 10s. per centum per annum on the amount of the deposit for the time being in the hands of the Corporation not so applied as aforesaid."

This section is still operative at Bury, and secures payment for damage done. The amount usually deposited is £10.

If rates, charges, or contributions were paid by users of traction engines and heavy motorcars for the use of the roads, they would fairly be entitled to ask in return that the roads should be so constructed as to carry the traffic, and to require that the money received by the road authority, after paying for the repair of actual damage done, should be applied for the purpose of improvement and reconstruction of the roads.

There should, however, in any case be power to restrict the traffic at particular times—*e.g.*, immediately after the break up of a frost or after a road has been repaired, and under particular circumstances. This may cause a little inconvenience to traction-engine owners, but such inconvenience would be better than the lamentable waste of public money that often occurs under the present system.

There should also be power to prevent nuisance and the damage to the surface of roads in hilly districts by engine drivers spreading sand, gravel, and other material to enable the wheels to "grip." The powers contained in Section 73 of the Highway Act, 1835, are hardly sufficient to adequately deal with this nuisance.

The dropping of hot ashes from the engine on to the road should be prevented.

Noisy engines should be prohibited.

The emission of smoke, steam, and objectionable vapour from the engine should be prevented. The provisions in existing statutes on this subject are not sufficiently effective.

The exemption of agricultural locomotives from being licensed should be confined to farmers and others owning such engines, and should not extend to owners who keep engines, not for their own use, but for the purpose of letting them out on hire at profit to themselves.

There are a number of other points that should receive consideration when the time comes for a revision of the law relating to traction engines and heavy motorcars.

Such a revision of the law is urgently necessary. The time has

come when the subject of traction engines and heavy motorcars (in fact, heavy traffic on roads) should have an Act of Parliament to itself.

Why should there be a distinction between traction engines and heavy motorcars?

Why should one class of locomotive have to be licensed and an annual fee paid in respect of such licence, and another class of locomotive (carrying quite as heavy weights) be only required to be registered once in its lifetime at a cost of 20s.?

Why should the driver of a heavy motorcar be required to be licensed and be made responsible for the carrying out of certain statutory requirements, and the driver of a traction engine be an unlicensed and irresponsible person?

Why should traction engines be prohibited by County Council by-laws from remaining stationary on any bridge or culvert, and heavy motorcars be not so prohibited?

It is hoped that there will be an amendment of the law relating to traction engines and heavy motorcars before long, and the distinction between these two classes of locomotive abolished.

PAPER 33: BY T. H. B. HESLOP, M INST.C.E., COUNTY SURVEYOR
FOR NORFOLK.

The increasing use of traction engines for haulage purposes renders it necessary that steps should be taken to obtain such alterations in the present Locomotive Acts as will in some measure safeguard the authorities who are responsible for the maintenance of our highways.

In the majority of counties a few years ago the only traction engines in use were those employed for agricultural purposes; these were generally moderate in weight (from 7 to 9 tons), hauled light agricultural implements, and travelled short distances.

Under the Locomotives Act, 1898, a train may be used upon the roads, consisting of an engine, weighing 14 tons when empty, drawing four wagons, each weighing $3\frac{1}{2}$ tons, and carrying a load of 9 tons 6 cwt. thus the total weight of the train may be no less than 66 tons.

The driving wheels of the locomotives above mentioned would be 7 ft. in diameter, 20 in. wide, and shod with diagonal bars. The wheels of the wagons would be about 3 ft. 6 in. in diameter, 8 in. wide, and smooth soled.

It is also permissible under the Act for a single article weighing more than 16 tons to be carried in a wagon having tyres only 8 in. wide, or 1 ton to each $\frac{1}{2}$ in. of tyre.

The effect of traffic of this character upon roads and bridges is most damaging. It is quite exceptional to find roads that have been constructed upon proper foundations; it will be generally found that they have been formed by simply placing layers of stone varying much in quality upon the natural subsoil without any artificial drainage. While roads of this character have proved strong enough to carry the ordinary traffic of the district without undue stress, they are quite incapable of doing so under the weights above mentioned, unless serious damage is to result.

The particular kinds of traction-engine traffic which cause the most damage to roads in this county are : (1) the regular haulage of goods, and especially timber, and (2) the use of very heavy engines by showmen for the purpose of removing their vans and machinery from place to place.

The former is generally taken over comparatively short lengths of road. The engine is invariably driven backwards and forwards in the same track, with the result that the driving wheels crush the road metal down into the foundation, and the carriages following in the same track complete the mischief by cutting through the already broken-up material into the subsoil.

The show engines, on the other hand, cover very great distances, and although necessarily the damage is not so apparent as when short lengths only are used, the disturbance of the surface, more especially after the break up of a frost, is most serious. It will then be noticed that the wheels regularly pick up patches of the road metal, depositing it again along the road in small pieces as the wheels revolve. It need hardly be explained that after this treatment the surface of such a road requires to be entirely renewed.

It is noticeable that the practice of overloading the engine is becoming more frequent ; apparently calculations are only made for hauling along a perfectly level road, with the result that when hills are encountered the engine is brought to a stand, the driving wheels ploughing up the road surface to the foundation before it is apparent that the load must be reduced.

It may be said that the cost of making good the damage caused by a good deal of this traffic can be recovered as extraordinary traffic under Section 23 of the Highway Act, 1878, but in the experience of the writer this is attended with so many difficulties that public authorities hesitate before putting the Act in force, and in a great number of cases carry out the necessary repairs at the public expense sooner than run the risk of losing an action at law.

The words in the Highway Act, 1878, Section 23, "by whose order," and altered in Section 12 (c) of the Locomotives Act, 1898, to "by or in consequence of whose order," has removed the great difficulty of ascertaining the person really responsible for causing the damage.

By Section 12 (b) of the Locomotives Act, 1898, it is necessary that any action to recover damages for extraordinary traffic of a continuous character shall be taken within six months from the completion of the contract for the work. It is almost impossible in many cases to prove this.

The writer was engaged in a case of extraordinary traffic, where large quantities of timber were conveyed along the roads by traction engines.

The work was carried on for nearly three years by the person who bought the timber. It might reasonably have been assumed that this work formed one continuous contract ; evidence, however, was given that the timber was paid for yearly, and that each payment completed the transaction.

It was held that each of these payments formed a separate contract, and, as an action was not taken within six months from the completion of such contract, damages were awarded for the last year only.

The greater volume of traction traffic, however, cannot be termed extraordinary, and the heavy cost of maintaining roads damaged by such traffic cannot be legally recovered.

It is not at all uncommon to find a highway authority compelled to expend large sums which they cannot by law recover in making good the damage caused by this class of traffic upon comparatively short lengths of road.

Bridges were originally constructed to carry only the ordinary light traffic of the district, but, owing to the increasing use of heavy engines for haulage, highway authorities have been compelled in recent years to strengthen, and in a great many cases to entirely rebuild, the bridges under their control, necessitating a very heavy expenditure.

In this county, from the year 1898 43 bridges and culverts have been strengthened or rebuilt at a cost of over £13,000, this being entirely due to the change in traffic conditions.

The responsible authorities under the Locomotives Act, 1898, may issue licences for the use of locomotives weighing not more than from 10 to 14 tons when empty, at a fee not exceeding £10 for the former and £18 for the latter. These licences are to be renewed annually.

Although owners must obtain these licences in the county in which their locomotives are ordinarily used, such is found not to be the common practice.

The maximum scale of charges for licences is not compulsory. In the case of ten authorities in adjoining counties it was found that the licence for an engine under 10 tons in weight varied from £2 to £10, and the additional fees for extra weights varied in the same manner.

The result of this is that owners obtain their licences where they are cheapest, and then by obtaining a daily permit for 2s. 6d. travel wherever they wish in other counties.

At a recent fair held in this county six engines were engaged. The whole of the licences had been taken out in adjoining counties, where the lowest charge was made, and the owners of four of these engines resided in this county.

It is, therefore, most desirable that a uniform scale of charges should be adopted, not only for licences, but for all purposes, and, in the opinion of the writer, these should be the maximum under the Act.

A daily travelling fee of 2s. 6d. is charged irrespective of the weight of the engine. This sum is a mere acknowledgment, and should be increased to 5s. as a minimum, and a sliding scale adopted, according to the weight of the engine, up to a maximum of 20s.

Power should be given to the surveyor in charge to close any roads to traction or other traffic after the break-up of frost or when, in his opinion, such traffic would cause unnecessary damage.

The diagonal bars upon driving wheels are the means of causing additional damage to the road surface, and if it is not possible to obtain a sufficient grip without using expedients of this description, which is doubtful, a less harmful method should be devised.

The driving wheels of locomotives should be increased in diameter and width proportionate to the weight of the engine, and the wheels of the wagons should also be similarly treated.

When traffic of this description is continuous, drivers should be

compelled to change track, and not continually use the same strip of road.

There is no desire on the part of public authorities to hamper such an important and necessary industry, but it is generally felt by those who are responsible for the maintenance of highways that some alterations are needed in existing conditions.

PAPER 34: BY R. S. W. PERKINS, COUNTY SURVEYOR OF THE ISLE OF ELY (SOUTHERN DIVISION), AND R. J. THOMAS M.INST.C.E., COUNTY SURVEYOR OF BUCKINGHAMSHIRE.

(a) CONTRIBUTIONS TO RATES AND TAXES.

Since the passing of the Locomotives Act in 1898 there has been a general increase in the use of traction engines for the haulage of merchandise and agricultural produce throughout the country, more especially in rural districts, and undoubtedly the additional cost of road maintenance is largely attributable to this cause. It is quite apparent that, compared with ordinary haulage, the owners of locomotives do not contribute towards the upkeep of the roads to any extent commensurate with the damage that is caused by their traffic. The only extra payment towards local taxation for which they are called upon is the amount of the annual licence, varying from £10 to £11 for a 10-ton locomotive, and not only is the actual wear on the roads infinitely greater in the case of traction engines, but they naturally cover a much larger mileage.

By those having practical experience in the management of roads it is a recognised fact that a traction engine, without hauling weights beyond the authorised limit, will in one journey during unfavourable weather cause as much damage to a road as the whole of an ordinary year's traffic, and where, as often happens, this is done by a locomotive licensed in some other county the only contribution received towards restoring the road is a maximum amount of 2s. 6d. for a daily travelling permit. This damage is more especially noticeable immediately after the break-up of a frost, and if traction engines were prohibited from using the public roads at such periods the cost of road maintenance would be considerably lessened.

Failing this general prohibition, power should be given to highway authorities to recover the cost of making good any damage that may be caused by traction engines travelling on the roads when, owing to the effects of frost, they are not in a suitable condition to withstand such traffic.

(b) LICENCES AND REGISTRATION.

Under the provisions of the Locomotives Act, 1898, councils are empowered to charge an annual licence fee not exceeding £10, with an additional maximum fee of £2 per ton if the weight exceeds 10 tons, and this has inevitably given rise to anomalies in the amounts fixed upon, as will be seen from the appendix to this paper. Section 9, Sub-section 2, of the Act provides that the licence shall be taken out in the county in which the locomotive is ordinarily used, or to be used, so that

where an engine is used in two or more counties the owner naturally procures his licence in the county charging the lowest fee, taking out an "additional licence" in the other county or counties. It seems most desirable that a uniform scale of fees should be fixed for every county, and it should be made compulsory for makers to state the tare weight on every locomotive, so that the correct fee might be ascertained by the licensing authority without recourse to weighing. In addition to the question of weight, the amount of the annual licence might be varied according to the character of the locomotive wheels, and also having regard to the number, class, and weight of the vehicles drawn.

Another point requiring amendment is in the definition of agricultural locomotives, which are merely registered upon payment of a maximum fee of 2s. 6d., as no distinction is made between engines kept by farmers for their own use and those let out on hire by contractors. It stands to reason that the latter are continually using the highways in hauling heavy threshing or ploughing implements, and it is only fair that they should be subject to an annual licence, though, perhaps, at a somewhat lower fee than locomotives used solely for haulage.

Under existing regulations a licensed locomotive is entitled to travel in any district upon payment of a fee not exceeding 2s. 6d. per day to the local authority, who appear to have no option in granting the permit. From the appendix it will be seen that upwards of 22,000 permits were granted last year, and in order to obtain a more equitable arrangement the amount of the daily fee should be considerably increased, and vary according to the weight of engine and load. Double fees should be charged during the winter months, and the local authority should have the option of refusing permit. In this connection no mention is made in the Act as to "registered" locomotives, and it is open to question whether a daily permit is required when travelling outside their own county.

The damage caused to roads by traction engines might be mitigated to some extent by more careful driving, and as at present no licence is required to drive a locomotive it often happens that a comparatively inexperienced man is in charge when travelling on the public highway. It appears only right that the licensing of locomotive drivers should be compulsory, and not only would this be an advantage to the highway authority, but it would also act as a safeguard to the general traffic on the roads.

(c) WEIGHT AND NUMBER OF WAGONS.

Up to the present no legal restrictions have been placed upon the tare weight of wagons.

The General Turnpike Act of 1822 (Section 12) prescribes gross weight, which includes wagon, varying according to width of tyre and time of year; the Locomotive Act, 1861, refers to the load *exclusive* of wagon; and the Heavy Motor Car Order, 1904, Article III., only refers to the maximum unladen weight of a trailer combined with that of the heavy motor.

Modern wagons can be obtained of a tare weight of about $2\frac{1}{2}$ tons, capable of carrying 8 or 9 tons of merchandise; and, as

unnecessary tare weight adds to the wear of roads, increases the weight of traction engines, thereby adding to the running cost, it is urged that, in the interests of all concerned, a maximum tare weight of $2\frac{1}{2}$ tons should be imposed for wagons capable of carrying loads up to 8 tons, increasing 2 cwt. in tare weight for each additional ton load.

The number of wagons now permitted appears to the author to be ample, and it should not be necessary to increase it, except in quite exceptional circumstances.

On winding narrow roads it is exceedingly difficult for the most considerate engine driver to avoid blocking and holding up other traffic, and as Section 5 of the 1898 Act has been so construed that the attendant therein referred to may be on the footplate with the driver, instead of on the rear wagon to signal the approach of overtaking traffic, it is most difficult for those in charge of such vehicles to make an engine driver hear through the din and rumble of his locomotive and three jolting trucks, whilst the loads on the latter may entirely obstruct his view of such traffic.

As it is generally the travelling showman who asks for a permit to haul additional vehicles, and only pays 2s. 6d. per day for his locomotive (which is frequently well up to the maximum weight, for generating electric light on show grounds), there appears to be no sufficient reason for sanctioning such additional vehicles, which are a greater inconvenience to the general body of road users, and add considerably to the cost of roads.

(d) WHEELS AND TYRES.

The issuing of the 1904 Heavy Motor Car Order marks a notable advance in the direction of reducing unnecessary weights and strains upon roads. First, by prohibiting the use of projecting diagonal metal cross-bars on engine-wheel tyres; and, second, by varying the maximum loads permitted according to the diameter of smooth-tyred wheels, thus recognising the obvious fact that the greater the diameter the more surface of tyre bearing longitudinally upon the road, and consequently the greater the area over which the load is distributed, and the lighter the pressure per square inch. As stated later, the weight per inch adopted as the unit in this Order is found in actual working to be much in excess of that which macadam roads can sustain.

It is highly desirable that heavy traction engines be similarly regulated, as the 3-in. cross-bars on their driving wheels, projecting $\frac{3}{4}$ in. and separated by 3-in. spaces, are destructive to a degree, in that the longitudinal bearing of such wheels when they first come in contact with the surface of an ordinary macadam road is practically confined to the width of a cross-bar, and continues so until such cutting edge, having deflected the road beyond its elastic limit, pierces the surface of road and brings adjoining cross-bars in contact with it.

Front wheels of traction engines should also conform to the Heavy Motor Car Order Regulations in the abolition of the narrow metal band so often found riveted round and projecting beyond the face of tyre.

Whilst projecting cross-bars and bands may be found necessary when traversing loose ground, agricultural land, etc., it cannot

now be maintained, in the face of the successful introduction of large plates with small grooves on heavy motor wheels, that cross-bars are essential for road haulage, unless it is intended to haul such exceptionally heavy loads as entail a tractive force only obtainable by the additional purchase or "grip" a locomotive obtains by the cutting of projecting cross-bars on its wheels into the fabric of road.

In all calculations of area of road brought under pressure it must be borne in mind that on convex country roads when metal-tyred vehicles traverse the centre, as they do approximately in the proportion of three to each one using the sides, the inner portions (nearest engine) of cylindrical tyres take first bearing upon the surface, the pressure on road rapidly decreasing towards the outer edge in proportion to the cross-fall in road. The author has found that on a strong granite road, with ruling cross-falls of 1 in 30 (general in modern English practice), from one-third to one-half the width of a 10-in. loaded heavy motor tyre takes no bearing when running along crown of road, and he is of opinion that in calculating area of such a road under pressure a cross measurement of 6 in. is all that should be taken.

The author cannot believe that the present-day traction engine wheel is by any means "the last word" in English mechanical engineering, if due consideration is given to its adaptability for the road it has to traverse, and which forms an integral part in the effort of locomotion.

At the Paris Road Congress the English-speaking delegates, drawn from road makers and users and engine manufacturers, expressed the unanimous opinion that, after four years' experience of the working of the Heavy Motor Car Order, 1904, the graduated weights allowed by such Order on axles with wheels of various diameters were excessive for macadam roads. The Order referred to sanctions an axle weight (portion of load and vehicle bearing upon one axle) based upon an unit of 840 lb. multiplied by the number of inches in width of wheels attached to such axle for a 36-in. wheel, and increasing 28 lb. for each 3 in. additional diameter. The delegates resolved to recommend the Congress to reduce this unit to 600 lb., but retaining the proportionate increase.

Comparing existing maximum with that proposed for a heavy motor with 36-in. driving wheel having 10-in. tyres, we get :

| | Width of Tyres. | Unit. | Back Axle Weight. |
|-------------------------|----------------------|----------------------|-------------------|
| | | | tons cwt. lb. |
| Present maximum | 10 in. + 10 in. = 20 | $\times 840$ lb. = 7 | 10 0 |
| Proposed ,, | 10 in. + 10 in. = 20 | $\times 600$ lb. = 5 | 7 16 |

The effect of this much-needed amendment would be that a heavy motor, which is now permitted an axle weight of $7\frac{1}{2}$ tons on a pair of 36-in. wheels, would require 60-in. wheels to carry this weight; an immense reduction in pressure upon roads, as the longitudinal bearing of the larger wheel is roughly proportionate to the increase in radius of wheel over that of the smaller one.

Probably because heavy motors and traction engines are but little used on the Continent, the Congress declined to amend the recommendation of their colleague, which was, strangely enough, identical with the 840 lb. per inch of the English Motor Car Order

for a 36-in. wheel, but differed materially from it by not specifying the diameter of wheel.

The author would draw particular attention to the fact that the Heavy Motor Car Order adopts the same unit for both axles of a heavy motor and for those of a trailer, although it is surely obvious that the wheels on an axle supplying the motive power must impose shearing and compressive stresses upon a road greatly in excess of those produced by wheels running free. It is most desirable that the unit be materially reduced in calculating weights upon live axles.

The author cannot help believing that the unit adopted in the Order was calculated for tyres running on a plane and not on a convex surface, such as the centre of an ordinary road, upon which much of the cross bearing must disappear. In practice it is essential to consider the maximum pressure anticipated upon a road, and not the mean.

Until traction-engine wheels are free from projecting cross-bars it is submitted that the benefit anticipated from their great diameter is lost, and that any calculations of pressure per square inch in comparison with that of smooth-soled heavy motor tyres is impossible.

Neither under the 1822 Turnpike Act (dealing with non-cylindrical wheels) nor in the 1861 Locomotive Act is any reference made to diameter of wagon wheels, and a drastic change is necessary in this respect. Weights should be regulated according to diameters, on the basis of the lower unit already suggested as an amendment in the Heavy Motor Car Order. It is also recommended that axles should vary in length, so that their wheels break track, and that tyres should be smooth.

Any appreciable increase in diameter of wheels of heavy motors or their wagons would no doubt necessitate longer axles, so that the wheels might clear the sides of vehicle, and thereby make it possible to keep decks to the present heights, but as traction engines can now be 9 ft. wide there is ample margin for this additional width.

If wagons are made lighter and larger wheels of equal strength to present ones constructed—as no doubt they can be with little added weight—there should be no diminution in the carrying capacity under new regulations, neither need there be any additional cost upon the owner. On the other hand, it would be of incalculable benefit to the road authorities and ensure better roads for all users.

APPENDIX.

TRACTION ENGINES AND HEAVY MOTORS IN ENGLAND AND WALES,
DECEMBER, 1908.

NOTE.—Registration figures represent total registered to date. Licence and daily permit figures are those for the last twelve months.

| Counties. | Traction Engines. | | | | | | Heavy Motors for commercial purposes registered to date at 20s. each. |
|--------------------------------|--|-----|---|-----|---|-----|---|
| | Agricultural engines registered to date at 2s. 6d. each. | 1 | | 3 | | 4 | |
| | | No. | Fees charged. | No. | Fees charged. | | |
| London | — | 14 | Maximum | 1 | Maximum. | 370 | 2,026. |
| Bedford | 140 | 3 | M | — | M | 102 | 10. |
| Berks | 196 | 16 | M | 9 | M | 716 | 17 |
| Buckingham .. | 164 | 12 | M | 8 | M | 465 | 14 |
| Cambridge | 210 | 39 | £2 for 10 tons, 10s. extra for each ton over. | 1 | £2 for 10 tons, 10s. extra for each ton over. | 18 | 8 |
| Chester ... | 148 | 8 | M | 2 | M | 215 | 430 |
| Cornwall | 156 | 34 | M | 1 | M | 134 | 14 |
| Cumberland .. | 63 | 8 | M | 1 | M | 106 | 5 |
| Derby | 124 | 27 | M | 6 | M | 420 | 8 |
| Devon | 238 | 40 | M | 2 | M | 566 | 15 |
| Dorset .. | 116 | 40 | M | 9 | M | 410 | 14 |
| Durham .. | 89 | 18 | M | 5 | M | 574 | 27 |
| Ely, Isle of .. | 195 | 16 | £2, and £2 for each ton over 10. | — | £2. 10s. for 10 tons, and £1 for each ton over. | 69 | — |
| Essex ... | 389 | 8 | M | 2 | M | 506 | 34 |
| Gloucester | 88 | 21 | M | 5 | M | 408 | 12 |
| Hampshire .. | 293 | 50 | M | 9 | M | 836 | 262 |
| Hereford | 31 | 18 | M | 4 | M | 322 | 12 |
| Hertford | 178 | 11 | £5 | 5 | £2. 10s. for 10 tons, £1 extra for each ton over. | 190 | 14 |
| Huntingdon | 117 | 9 | £2 for 10 tons, 10s. extra for each ton over. | — | — | 99 | — |
| Kent | 350 | 87 | M | 11 | M | 133 | 143 |
| Lancaster | 158 | 32 | £10 for 10 tons, £1 extra for each ton over. | 10 | M | 222 | 144 |
| Leicester | 109 | 6 | M | — | — | 180 | 7 |
| Lincoln (Parts of Holland). | 12 | 5 | £5 for 10 tons, £1 extra for each ton over. | — | — | 53 | — |
| Lincoln (Kesteven) | 253 | 17 | £5 for 10 tons, £1 extra for each ton over. | 1 | M | 142 | 4 |
| „ (Lindsey) | 286 | 38 | M | 3 | M | 76 | 4 |
| Middlesex | 34 | 3 | M | 4 | M | 716 | 68 |

HEAVY MOTORS AND TRACTION ENGINES. 169

| Counties. | Traction Engines. | | | | | | Heavy Motors for commercial purposes registered to date at 20s. each. |
|-----------------------------|--|---|-----------------|---|----------------------|---|---|
| | Agricultural engines registered to date at 2s. 6d. each. | 1 | | 3 | | 4 | |
| | | 2 | | 3 | | | |
| | | Traction engines licensed during past year for general haulage. | | Traction engines taking out additional licences during past year. | | Daily permits issued at 2s. 6d. during past year. | 5 |
| | | No. | Fees charged. | No. | Fees charged. | | |
| Monmouth | 25 | 4 | M | 6 | M | 289 | 10 |
| Norfolk | 567 | 29 | £5 for 10 tons. | 5 | £2. 10s. for 10 tons | 164 | 25 |
| Northampton | 173 | 1 | M | — | — | 243 | 13 |
| Northumberland | 128 | 14 | M | 4 | M | 366 | 25 |
| Nottingham | 209 | 10 | M | 2 | M | 520 | 16 |
| Oxford | 183 | 20 | M | 5 | M | 626 | 12 |
| Peterborough, Soke of | 56 | — | — | — | — | 78 | 1 |
| Rutland | 44 | 2 | M | 2 | M | 25 | 2 |
| Salop | 110 | 20 | M | 1 | M | 202 | 6 |
| Somerset | 121 | 34 | M | 6 | M | 587 | 24 |
| Stafford | 94 | 19 | M | 7 | M | 231 | 17 |
| Suffolk, East | 176 | 20 | £5 to £10. | — | — | 76 | 16 |
| „ West | 145 | 5 | £5 and upwards. | 4 | £2. 10s. & upwards | 131 | 4 |
| Surrey | 92 | 16 | M | 7 | M | 1,107 | 20 |
| Sussex, East | 84 | 19 | M | 3 | M | 323 | 6 |
| „ West | 109 | 12 | M | 5 | M | 414 | 5 |
| Warwick | 105 | 3 | M | 4 | M | 470 | 8 |
| Westmorland | 1 | 6 | £5 and upwards. | 1 | £5 | 149 | 2 |
| Wight, Isle of | 16 | 4 | M | — | — | 11 | 3 |
| Wilts | 238 | 22 | M | 5 | M | 341 | 14 |
| Worcester | 80 | 13 | M | 3 | M | 234 | 12 |
| York, East Riding | 13 | 50 | £5 | — | — | 36 | 17 |
| „ North „ | 207 | 6 | M | 8 | M | 262 | 6 |
| „ West „ | 274 | 87 | M | 10 | M | 448 | 72 |
| Anglesey | — | — | — | — | — | 4 | — |
| Brecon | — | 1 | M | 1 | M | 126 | — |
| Cardigan | — | — | — | — | — | 50 | — |
| Carmarthen | 1 | 3 | M | — | — | 76 | 11 |
| Carnarvon | — | 5 | M | 1 | M | 3 | 8 |
| Denbigh | 5 | 8 | M | 3 | M | 148 | 11 |
| Flint | 3 | 19 | M | 6 | M | 75 | 10 |
| Glamorgan | 6 | 27 | M | 4 | M | 55 | 31 |
| Merioneth | 1 | 2 | M | — | — | 11 | 1 |
| Montgomery | — | — | — | 1 | M | 43 | — |
| Pembroke | 58 | 11 | M | — | — | 27 | 2 |
| Radnor | — | — | — | — | — | 35 | — |
| | 7,461 | 1,058 | | 202 | | 15,664 | 1,676 |
| COUNTY BOROUGHs. | | | | | | | |
| Barrow-in-Furness ... | 5 | — | — | — | — | 10 | 5 |
| Bath | — | — | — | 5 | M | 164 | — |
| Birkenhead | — | — | — | — | — | 30 | 3 |
| Birmingham | — | — | — | 4 | £4 | 111 | 49 |
| Blackburn | — | 3 | M | — | — | 51 | 7 |
| Blackpool | — | — | — | — | — | — | 2 |
| Bolton | 4 | 2 | M | — | — | 129 | 29 |
| Bootle | — | — | — | 1 | M | 78 | 5 |
| Bournemouth | — | 5 | M | 8 | M | 59 | 12 |
| Bradford | — | 2 | M | — | — | 235 | 107 |

| Boroughs. | Traction Engines. | | | | | | Heavy Motors for commercial purposes registered to date at 20s. each. | |
|-----------------------|--|---|---|---|---|---|---|---|
| | Agricultural engines registered to date at 2s. 6d. each. | 2 | | 3 | | 4 | | |
| | | Traction engines licensed during past year for general haulage. | | Traction engines taking out additional licences during past year. | | | | |
| | | No. | Fees charged. | No. | Fees charged. | Daily permits issued at 2s. 6d. during past year. | | |
| Brighton | — | — | — | — | — | 75 | 9 | |
| Bristol | — | 4 | M | 10 | M | 264 | 29 | |
| Burnley | — | — | — | — | — | 99 | 1 | |
| Burton-on-Trent | — | 1 | £5 | — | — | 90 | 17 | |
| Bury | — | — | — | — | — | — | 4 | |
| Canterbury | 10 | 6 | £5 for 10 tons, £2 extra for each ton over. | 4 | £2. 10s. for 10 tons, £1 extra for each ton over. | 48 | 2 | |
| Chester | — | — | — | — | — | 46 | 1 | |
| Coventry | — | — | — | 3 | M | 92 | 12 | |
| Croydon | 10 | — | — | 1 | M | 100 | 5 | |
| Derby | 1 (a) | 1 | £5 if registered in county, £10 if not. | — | — | 85 | 4 | |
| Devonport | — | — | — | — | — | 30 | — | |
| Dudley | — | 1 | £5 for 10 tons, £2 extra for each ton over. | — | — | 91 | — | |
| Exeter | — | — | — | 1 | M | 196 | 1 | |
| Gateshead | 1 | — | — | 6 | M | 206 | — | |
| Gloucester | — | 1 | M | 1 | M | 176 | — | |
| Great Yarmouth | — | — | — | — | — | — | 3 | |
| Grimsby | — | No charges; by-laws under consideration. | | | | | 4 | |
| Halifax | — | — | — | — | — | 113 | 2 | |
| Hanley | — | 1 | £1 | — | — | 24 | 2 | |
| Hastings | — | — | — | — | — | 26 | — | |
| Huddersfield | — | — | — | — | — | 112 | 6 | |
| Ipswich | — | No registration or licence required in borough. | | | | | 6 | |
| Kingston-upon-Hull .. | — | — | — | 3 | M | 67 | 8 | |
| Leeds .. | — | No charges; by-laws under consideration. | | | | | — | |
| Leicester .. | — | — | — | — | — | 57 | 7 | |
| Lincoln .. | — | — | — | — | — | — | 73 | |
| Liverpool .. | — | 2 | M | — | — | 96 | 48 | |
| Manchester .. | — | None registered. | | | | | 98 | |
| Middlesbrough | — | — | — | 1 | M | 18 | 4 | |
| Newcastle-on-Tyne .. | — | 6 | M | — | — | 102 | 27 | |
| Newport (Mon.) | — | — | — | 2 | M | 56 | 10 | |
| Northampton | — | — | — | — | — | 57 | 11 | |
| Norwich .. | — | 1 | £5 | — | — | 91 | 6 | |
| Nottingham | 1 | — | No registration or licence insisted upon. | | | | | — |
| Oldham | — | 3 | £1. 1s. | — | — | 50 | 7 | |
| Oxford ... | — | — | — | — | — | (about) | — | |
| Plymouth | — | 1 | M | — | — | 26 | — | |
| Portsmouth | — | 1 | M | — | — | 36 | 6 | |
| Preston | — | 1 | M | — | — | 36 | 44 | |
| Reading | 6 | 3 | M | 4 | M | 217 | 6 | |
| Rochdale | — | 1 | M | — | — | 105 | 2 | |
| Rotherham | 16 | 1 | £5 | — | — | 292 | 3 | |
| St. Helens | — | — | — | — | — | 36 | 3 | |
| Salford | — | 1 | M | — | — | 315 | 6 | |
| Sheffield | — | — | — | — | — | 260 | 18 | |
| Smethwick | — | 1 | M | 2 | M | 23 | 1 | |

HEAVY MOTORS AND TRACTION ENGINES. 171

| Boroughs. | Traction Engines. | | | | | | Heavy Motors for commercial purposes registered to date at 20s. each. |
|----------------------|--|---|--|---|---------------|---|---|
| | Agricultural engines registered to date at 2s. 6d. each. | 2 | | 3 | | 4 | |
| | | Traction engines licensed during past year for general haulage. | | Traction engines taking out additional licences during past year. | | | |
| | | No. | Fees charged. | No. | Fees charged. | Daily permits issued at 2s. 6d. during past year. | 5 |
| Southampton | — | — | — | 1 | M | 204 | 7 |
| Southport | — | — | — | — | — | — | 1 |
| South Shields..... | — | — | — | — | — | 44 | — |
| Stockport | — | — | — | — | — | 148 | 21 |
| Sunderland | — | 2 | M | — | — | 27 | 8 |
| Tynemouth..... | 1 | — | — | — | — | — | — |
| Walsall | — | — | — | — | — | 3 (b) | — |
| Warrington | — | — | — | — | — | 70 | 1 |
| West Bromwich..... | — | — | — | — | — | 112 | — |
| West Ham | — | — | — | — | — | 63 | 4 |
| West Hartlepool ... | — | — | — | — | — | 9 | 1 |
| Wigan | — | — | — | — | — | 52 | 6 |
| Wolverhampton | — | — | — | — | — | 226 | 6 |
| Worcester | — | — | — | 1 | M | 115 | 2 |
| York | — | 3 | £5 | 2 | £3 | 116 | 4 |
| Cardiff | — | 3 | M | — | — | 117 | 23 |
| Merthyr Tydvil | — | — | — | 1 | M | 50 | — |
| Swansea | — | 2 | £5 for 10 tons, £2 extra for each ton over. | — | — | 59 | 2 |
| | 55 | 65 | | 61 | | 6,095 | 805 |

SUMMARY.

| | | | | | | | |
|------------------------|-------|-------|---|-----|---|--------|-------|
| County of London | — | 14 | — | 1 | — | 370 | 2,026 |
| County councils | 7,461 | 1,058 | — | 202 | — | 15,664 | 1,676 |
| County boroughs | 55 | 65 | — | 61 | — | 6,095 | 805 |
| | 7,516 | 1,137 | | 264 | | 22,129 | 4,507 |

NOTES.—“M,” and “Maximum,” in Columns 2 and 3 indicate that the full charge of £10 up to 10 tons and £2 for every ton or portion of a ton in excess, and £5 and £1 respectively for additional licences are made.

(a) No charge is made for registration of agricultural engines.

(b) 1s. charged for daily permits.

No doubt a number of registered agricultural engines have ceased to work, but probably the traction engines and heavy motors in the towns where no licences or registration seem to be required would balance this.

* Approximately.

DISCUSSION.

Mr. A. H. SCOTT, M.P., presided over the afternoon sitting, and said motors had come to stay, and more particularly heavy motors. If they had an alteration of their system in land that would bring about a combination of those interested in cultivation, the result he believed would be that farmers generally in the country would combine together and find their markets along the main roads. He hoped that everyone would do their best to bring the discussion into accordance with what they believed would be the effective means of relieving municipalities and local authorities from the heavy cost they now had to bear.

Mr. T. C. AVELING (Royal Automobile Club) observed that the problem to be considered was the lowest tare weight to carry or move the heaviest load, so that proportionately for the load carried the total moving weight per axle was decreased. He did not agree with Mr. Copnall that an engine let out for hire for distinctly agricultural purposes should be more heavily taxed. This engine was being used for the benefit of agricultural interests, an interest of the utmost importance to be protected. Mr. Copnall stated that there was no power to enable a road authority to restrict heavy traffic on the roads. The by-laws of many towns and claims for extraordinary traffic had nearly made the road locomotive or traction engine useless for ordinary use, and there was power under the Heavy Motorcar Order given to road authorities enabling them to cause heavy motorcars to run according to the order. Many of them knew that these heavy motorcars ran at an illegal speed and with an illegal axle weight, so deteriorating the roads unnecessarily. He considered that the figures proved that the increased cost in the upkeep of roads was due to the heavy motorcars rather than to road locomotives, since from his personal knowledge the output of road locomotives had decreased, whereas the output of heavy motor vehicles and tractors had increased. They had traction engines in use before the heavy motorcar, and the increased cost in the roads occurred at the advent of the heavy motorcar. He agreed with Mr. Heslop that a uniform scale of fees should be adopted for all engine licences, and power should be given to surveyors to close roads made under present methods during certain climatic conditions; further, that drivers of heavy locomotives and traction engines should be licensed. He agreed also with Messrs. Perkins's and Thomas's suggestion that a maximum tare weight for trailers would be an advantage. A revision of the law was asked for, but for heavy road locomotives by-laws formulated by various authorities together with fines for extraordinary traffic had

already led to the disuse of these engines, and as regarded heavy motorcars, a careful and insistent use of the powers conferred upon road authorities by the Heavy Motorcar Order would to a great degree diminish the present heavy wear and tear on roads due to the illegal weights and speeds at which these heavy motorcars were run.

Mr. J. C. McGRATH (West Riding) stated that the view they took was that an agricultural locomotive did not require to be licensed, and a daily permit was looked upon as a daily licence.

Mr. JOHN ASPINALL (Lancashire) asked the meeting to pass forward to Saturday's plenary meeting a recommendation for greatly increased duties both from locomotives and from heavy motorcars, which were doing great and increasing damage to the country roads.

Mr. A. HOGG (Elgin) urged that the matter could be best dealt with by new legislation and the establishment of a small central authority. They ought to get the exact amount of road assessments collected in every area during the 10 years from 1890 to 1900, and make a return of rates given.

Mr. WOOD HOMER commented upon the improper use of the roads by locomotive owners, and contended that unprofitable traffic ought not to be encouraged. They ought to make all engines answerable for improper use of the roads, whether by extraordinary traffic or in any other way. They should be made answerable to the road authorities who had to repair the roads.

Mr. FLETCHER (Dorset) regarded it as most unfair to the ratepayers that owners of locomotives, for the sake of earning a few pounds, should do such immense damage.

Mr. ROWLATT (Leicestershire) contended that the highways were really being used as railways, and they ought to take care that those who used an article should pay for it.

Mr. REES JEFFREYS urged that the consumer, and not the private manufacturer, was going to benefit by the reduction in the general cost of transport. Anything that could reduce the cost of transport was to the benefit of the industries of the country. It was a monstrous proposition that because by an improved method of road transport they were able to reduce the charges previously paid, thereby and therefore that additional taxation must be put upon that improved method of transport. The roads existed to be damaged, and everybody did damage to some extent. He contended that railway and canal companies in many cases did not maintain their bridges in a proper condition of strength to carry traffic. There was no power at present which enabled a County Council to compel a railway company to maintain its bridges up to a standard of strength to which it was originally built, much less to bring it up to the required strength for increasing traffic.

Mr. R. LAMBIE (Lanark) thought they ought to differentiate

between traction engines and motorcars used for trade purposes and luxurious purposes. They ought to make the most of their roads to meet the new development of things.

Mr. T. MOSLEY (Bucks), speaking as a director of a railway company and canal company, held that the companies suffered from a great grievance because they had been called upon over and over again to allow a class of traffic to pass over their railways and canals for which the bridges were never designed and for which the burden of the upkeep was never imposed on them. The bridges ought to be bought from them and kept up, and they would be glad to hand them over. They ought to be taken over at a fair valuation.

Mr. MORESBY WHITE (Motor Union) declared that if this matter were properly put before the people of the country, they would realise the value of the asset of which the authorities were the protectors. They should be asked whether it was not better for them that they should have the improved method of locomotion, and if they said it was, it ought to be paid for and proper administration should accompany it.

Mr. Scott, M.P., at this stage vacated the chair, which was taken by Sir H. Bacon.

The discussion was continued by Mr. H. STURMEY, and the authors of the papers replied to the points raised.

FRIDAY, APRIL 30.

SECTION B.

DUST.

CHAIRMAN :

C. D. ROSE, M.P.

SECRETARY :

E. H. LISTER.

TECHNICAL SECRETARY :

ALLAN STEVENSON.

Papers 24, 25, and 26 were taken as read, as follows :

PAPER 24 : BY A. DRYLAND, ASSOC.MEM.INST.C.E., COUNTY SURVEYOR OF SURREY.

The subject of this paper is a very urgent problem—first, for the sake of the health and comfort of all users of and dwellers near the King's highway ; and, secondly, because of the depreciation in value of all property abutting upon the chief arteries of traffic.

Inasmuch as dust is present everywhere during certain conditions of atmosphere, it is certain its entire avoidance is a physical impossibility, but a great deal ought and can be done to reduce the quantity, and, the author also hopes, something to prevent the undue disturbance of that residue which is unavoidable.

In extended periods of dry, and particularly windy weather, dust has always in our time caused a certain amount of trouble and annoyance, but it will, no doubt, be freely acknowledged that until the advent of fast-moving self-propelled vehicles the extent of the nuisance was not of serious import. In the author's view, it is established beyond all doubt that self-propelled vehicles not only raise and distribute dust in a manner quite unknown previous to their introduction, but also are very largely responsible for its creation. It is in a modification of design that we must look to a great extent for a mitigation of the dust nuisance. The author would strongly urge, in the first place, that such barbarous adjuncts as steel studs and chains, which subject the road surfaces to continual filing or scarifying action, should be prohibited—by law if necessary. There is little doubt, too, that the lower the car body the more effective the car becomes as a dust raiser.

The author raises these points in the hope that those who use motors and those who are interested financially in the motor industry will devote themselves with energy to doing their part towards lessening the dust nuisance.

Passing from this phase of the problem to that of the highways themselves, it will be useful to consider first from whence comes the dust. The author thinks it may be chiefly grouped under the four heads :

1. Dust blown upon the highways from fields and other surroundings, and that due to animals.
2. Dust brought upon the highways in the form of soil or dirt from fields and other premises, and dirt, dust, and other refuse thrown or swept thereon.
3. Dust due to the nature of the highway itself, both as regards foundation and surface
4. Dust due to wear and tear of the surface.

With regard to the dust blown upon the highway, this must be accepted as unavoidable. There would seem to be no mitigation possible other than that of adequate scavenging and watering, or the application of some dust-laying compound. So far as the dust arises from animals upon the highway, it is likely to be of a diminishing character if the displacement of the horse proceeds at its present rate.

In the author's view, the dust arising from the causes enumerated under No. 2 is largely preventable, and ought to be prevented.

Enormous quantities of dirt and filth are brought upon the public highways by the wheels of vehicles from fields, yards, and badly kept cartways, and by droppings from overloaded vehicles. It is quite a common sight in an agricultural district to see a long length of road plastered with a mixture of soil and manure, and almost as common an occurrence to see the whole surface of the road destroyed by the pulling of the surface due to the plastic mixture thus formed. The author has frequently seen at least £50 damage done by one farmer in a single day in manure or root hauling under unfavourable conditions, damage which might have been prevented by the expenditure of a few shillings in cleaning wheels and in keeping the means of access to the road in a decent condition. In the author's view, this is an unjustifiable abuse of the highway, and the law should be so strengthened and administered as to effectually prevent soil, filth, dirt, or refuse being so brought upon the highway unless unavoidable.

With regard to the dust referred to under head No. 3, due to the nature of the highway itself, there is no doubt the ordinary water-bound macadamised road is the worst of all the forms in this respect. In using the term "macadamised" I do so in its original meaning, including thereunder all roads made of compacted broken stone, and not in the limited sense in which it is often now used as applying only to surfaces coated with broken granite.

To find a pitched foundation to an old road is quite exceptional, even in a district where fairly hard rocks are plentiful.

A very large proportion of our present-day roads, except those of quite recent construction, may be said to have grown, or developed, rather than to have been made. Many of them were originally mere tracks, and have arrived at their present state through the accretion of many coats of ground-up stone, often of very poor character, possibly faced with a thin crust of granite, or even some inferior material.

In consequence, the road crust consists very largely of fine material, which, when sodden with moisture, exudes mud freely, and unless the road crust is fairly thick the moisture affects the soil underneath, and that also to some extent oozes up through the metal. These causes account for a large proportion of the dust in macadamised roads, but a further large quantity is added in the form of what is termed "binding," or sometimes, rather appro-

priately, "blinding," material. All sorts of stuff have been, and still are, used to a certain extent for this purpose, ranging from clay, sand, and more or less clean road scrapings to the finer grades of the hard coating materials. In the author's view, the greatest practicable improvement possible in the construction of water-bound macadamised roads is to be found in the use of the very hardest and toughest coating materials well consolidated by rolling, with the addition of just sufficient fine chippings during the consolidating process to completely fill the voids between the stones. Such a form of macadamised road will, for the present, meet the requirements of those roads subject to a moderate traffic, including a fair quantity of motors, particularly if the speed of this class of vehicle is kept within reasonable limits. Where the motor traffic becomes so extensive as to cause a serious nuisance by reason of dust, or unduly destructive by disintegration of the surface, a great advance in the direction of dustlessness can be attained, and also a very large measure of protection from disintegration, by a surface dressing of tar or other good bituminous compound. To get the best results from this process the author considers the following points essential:

1. The surface must be good—that is to say, it should be treated before any considerable degree of wear has taken place upon the macadam coating.
2. The weather must be suitable and the road perfectly dry.
3. The surface must be thoroughly swept, so as to remove all fine dust and leave a slight space for keying between the stones.
4. The tar, or bituminous compound, must be of good quality, free from too volatile matters, but not sufficiently so as to render it brittle and impair its cementitious and elastic qualities.
5. It must be applied hot, and be allowed to soak into the crust of the road, and be blinded with a coarse grit or a fine grade of granite chippings.

Such a surface treatment is very efficient by reason of the protection afforded the road crust from atmospheric influences, preventing exudation, also forming a surface which takes up a considerable proportion of wear, and particularly in regard to the prevention of disintegration, which leads to so much wear and tear, and consequently mud and dust.

With regard to the mode of applying this surface treatment, the author ventures to say there is a general consensus of opinion among surveyors, who should be the most competent judges, that what is known as the application by hand is the most durable and effective. Owing, however, to the somewhat greater expense and comparative slowness of this method there is a very useful field open for mechanical spreaders, in order that advantage may be taken of suitable weather conditions in our generally fickle climate.

The author ventures to say that application by force is not necessary or effective; penetration cannot be attained by these means, but only by absorption.

Another means of largely minimising dust on macadamised roads is by the use of a matrix either of a cementitious nature or of a bituminous character as a binder, instead of the usual kind of water binding. Certain forms of mortar or cementing materials have been used, but the author is not aware of any

sufficiently prolonged test to demonstrate their complete success under great traffic.

A bituminous matrix has been more largely used, and has met with very considerable success, particularly upon roads subject to a medium traffic. The process is considerably more expensive than surface tarring, and, in the author's view, it has yet to demonstrate its relative superiority over that method, bearing in mind the relative cost.

DUST DUE TO WEAR AND TEAR.

Under the preceding head the author has dealt to some extent with the above so far as it relates to macadamised roads. It may be useful, however, to call attention here to the rapid wear and tear on uneven surfaces, particularly so with rapidly moving cars with studded tyres and heavy vehicles. It is, therefore, incumbent in the battle against dust to keep the surfaces as even as practicable. A very small depression acted upon by the shocks of fast moving traffic causes a great intensification of wear and tear. In the author's view, as traffic develops, it will become necessary to form and keep very smooth and tenacious surfaces. The consolidation of macadam by the use of a steam-roller, while a great advance on the methods of our forefathers, is not by any means capable of producing a true surface.

The nature and extent of the traffic must be the ruling factor in the kind and strength of surface to be provided, all of which have their limits. When the "macadam limit" is passed some form of paving must be adopted. In our present state of knowledge this takes the form of wood, granite paving, or mineral asphalt.

With regard to tar macadam, which has been extensively tried, the author desires to put forward the view that when the relative expenditure is taken into consideration it has not shown any considerable advantage over granite macadam roads, if the latter are surface tarred. It has the advantage that yearly surface applications are not absolutely necessary, although the author is of opinion that such treatment is desirable for maintenance purposes. Tar macadam has the disadvantage of not being easily repaired. It is true it can be patched, but not so easily as ordinary macadam. It forms a satisfactory road for small towns and villages, but its first cost is prohibitive for general use on country roads under the present financial conditions, and it is not good enough for the heavy traffic in large towns or on important roads adjacent to the large centres of population.

For such situations where the gradient permits, both for wear and tear and dust prevention the author considers mineral asphalt the most suitable surface, particularly if it can be used in such a form as to give a slightly resilient surface. Its great advantage under modern traffic conditions is the true surface which can be attained. Hitherto its first cost has been so high as to restrict its use to the most important centres of traffic. Quite recently a departure has been taken from laying it on a cement-concrete bed—which is very costly—and tar concrete has been used instead. The author hopes this method may prove successful, as the more elastic bed may prove an advantage, and if a satisfactory method can be found of turning the old road metal to use in forming the tar concrete base a considerable reduction in cost might be affected.

Both wood and granite paving have the disadvantage of

having a large number of joints to retain mud and dust. While kept in a smooth condition they are both very lasting, particularly the latter, which is probably the most durable of all kinds of paving known at present, and if laid with true-faced setts, with very narrow joints, filled with a mineral asphalt composition, it would provide probably the most durable and dustless paving attainable in our present state of knowledge for self-propelled traffic, but very trying to the legs and feet of horses.

To summarise the matters dealt with in this paper, the author ventures to put forward the following conclusions :

1. That absolute dustlessness is unattainable, and consequently watering, or dust-laying application, must always be necessary, as well as frequent scavenging.

2. That comparative dustlessness can best be attained :

(a) By such reduction of wear and tear as is obtainable by the abolition of all unduly destructive forms of wheel coverings.

(b) By such improvements in the design and construction of self-propelled vehicles as will minimise their dust-raising proclivities.

(c) By the prevention of all avoidable extraneous dust being brought upon the highways.

(d) By improved methods of forming water-bound macadam surfaces for the lighter traffic roads.

(e) By the surface treatment with tar or bituminous compounds of macadamised surfaces under suitable conditions, and by the use of tar macadam and bituminous binders where the nature and extent of traffic and other circumstances render it desirable.

(f) By the production and maintenance of the smoothest possible surfaces for all kinds of roads.

(g) By the use, as far as possible, of smooth, tough, and, if possible, slightly resilient forms of paving for the heavier grades of traffic.

PAPER 25 : BY THE RIGHT HON. LORD MONTAGU OF BEAULIEU, MEMBER OF THE HIGHWAYS COMMITTEE OF THE HAMPSHIRE COUNTY COUNCIL, MEMBER OF COUNCIL ROAD IMPROVEMENT ASSOCIATION, ETC.

How Dust is Created.

Although numerous experiments have been made during the last few years in the production of dustless materials for road-making, and fluids to put upon roads to prevent dust rising from it, there has not been, so far as I am aware, much attention given to considering what actually creates dust.

[O]f course, it is known that some kinds of road metal that are of a friable nature crush more easily under the stress of traffic, and produce detritus in greater or less quantities. And in towns it is well known that from a half to two-thirds of the so-called dust in streets is really faecal animal matter. But the processes by which the road produces dust, either by the action of wheels, hoofs, frost, sun, or rain, are still somewhat obscure.

The principal ways in which dust is created are not many in number, and the chief cause of dust, as apart from the method of its production, is to be found in the use of unsuitable road material. However well a road may be made, and however little traffic, com-

paratively speaking, may use it, a road made with mud and a few stones will always remain muddy when wet and dusty when dry. Having, for sake of clearness, put forward this obvious axiom, it remains to be seen by what processes weak and unsuitable material or friable stone becomes dust or mud.

In the first place, the greatest creators of dust may be taken to be the hoofs of animals. Although wheels create dust also, even when rolling over the road without exerting any propelling force, they do not make dust to anything like the same extent. But in the case of the hoof of an animal, especially when it is steel shod, there is always a prodding and screwing action at some period during the time the hoof is on the ground, which makes dust and disintegrates a road in a way unlike any other agency. For instance, the attrition produced by the hind steel-shod hoofs of the horse in drawing a load is infinitely greater than that produced by the prodding action of the front hoofs, though the latter seriously loosen the surface of a road not well bound together. The truth of this statement is proved by observation of narrow single-track roads, where the centre will almost invariably be found to be hollowed out, while the spaces on each side on which the wheels run retain for a much longer time their shape, and wear much better than the centre. Horses employed in agricultural operations, such as ploughing, rolling, harrowing, etc., in addition to cows, bullocks, sheep, pigs, and other animals, are also creators of mud, and, therefore, of dust in another way. Everyone must be acquainted with one of the common features of the roads in autumn, when the carting to the homestead of either turnips or mangolds is taking place, or in the spring, when the plough and harrow are being used to prepare the seed bed for corn. In each case in the neighbourhood of the gate leading into the field in which these operations are taking place will be found clods of clay and earth, which, when broken up, make dust in summer and mud in winter. In the sheep districts, a flock passing along will absolutely disintegrate the road and convert it from an excellent surfaced highway into one covered with small broken stones. In the winter a hundred sheep or so coming out of a muddy root field will spoil the surface of a highway for many yards each side of the place from which they have come. Horned stock are, perhaps, not quite so bad, but anyone who has knowledge of roads in the grass and dairy counties knows that between the pastures on which the animals are fed and the homestead in which they are milked or fattened, as the case may be, the road is always muddy in winter and dusty in the summer time. Then there are the military causes of dust. It may be said that four battalions of infantry, even with their transport, do not cut up the road as much as a single battery of artillery or a regiment of cavalry. Thus wherever it is found, the horse is the most serious factor in the creation of dust, and the 5-cwt. battering-ram, as each leg of the horse has been called, undoubtedly gives the road a succession of very heavy blows, apart from its screwing or prodding action, and disintegrates its surface far more than is generally realised.

The second most potent creators of dust are narrow-tyred, heavily-laden carts. Every road with a reasonable camber frees itself from the greater part of the small detritus which is inseparable from general traffic by the flow of water during rain from the centre to the sides. If the grass edges of roads be

examined it will be found that the stems of the grass have collected a considerable depth of such small grit, varying from $\frac{1}{2}$ in. to 2 in. or 3 in. deep. This road detritus is continually being washed and blown to the roadsides if the slope of the road is regular. But this natural and salutary process is largely arrested by the deep longitudinal ruts caused by heavily-laden carts fitted with tyres of too narrow a width. This is best seen in the average country lane on a muddy day. The water will, as a rule, be seen standing, not in round-shaped puddles, but in longitudinal troughs, the too narrow tyres of carts having cut through the soft surface on the top and created these channels in which the water is collected, and in which also the detritus from the higher parts of the road gather and form mud so long as the surface is damp, and dust when the sun again dries it. It matters not how well the tabling on the edge of the road has been done, nor how efficiently the gutters have been cleaned out, nor even if the road has an unusually high camber, the passage of narrow-tyred, heavily-laden vehicles will destroy any uniform surface which the road engineer may devise, and gradually, from the creation of many channels, a trough appears exactly following the tracks of the wheels. In these depressions water will stand, collecting detritus and rotting the rest of the road. Of course, where a very hard surface has been provided, such as granite setts, asphalt, wood pavement, or tar macadam, the damage is not so great. But the tendency to destroy exists wherever the narrow tyre runs.

It is interesting to record the fact that many years ago Parliament and the road authorities in England were quite well aware of the excessive and unnecessary damage done to roads caused by such vehicles, for by an Act of George III., Chapter 84, Section 85, it was provided that tolls should vary in accordance with the width of the tyres upon the wheels. Of course, the intended effect of this law was to encourage the use of broad tyres. Even in our own time the destructive nature of narrow tyres has been officially taken notice of, for in the New Forest to-day, and in some of the surrounding manors, no timber carting is allowed to be done over the roads in the enclosures and woods unless the wheels are fitted with tyres of at least $4\frac{1}{2}$ in. in diameter. This precedent might be well followed elsewhere. Again, with regard to traction engines, this point has been recognised in the regulations laid down by the Local Government Board, which prohibit the use of these engines unless they possess tyres varying in size according to weight, in order to prevent the road being destroyed by its surface being crushed in. In any comprehensive reform regarding the use and administration of highways the compulsory use of broad as against narrow tyres for vehicles carrying heavy weights should be carefully considered, for there is no doubt that disintegration and the subsequent production of dust is largely caused by narrow tyres.

A third cause of dust and mud is the want of proper foundation of the road apart from its surface. There is nothing more eloquent of this fact than the result produced by laying just a thin screening of granite on the top of chalk or other soft subsoil. Given a frost and a rapid thaw, or a fortnight of wet weather, and between each piece of basalt or granite will be seen oozing up a thin film of chalky mud, almost appearing to have been sucked up by some

vacuum from below. The fact really is that each stone above moves with the traffic passing over it, and the effect of this is to loosen the subsoil, disintegrate it, and force it up wherever a crevice exists through which it can pass. In the case of roads made with inferior water gravels, whether drawn from beds containing deposits of a former age or from the bed of a neighbouring river, if the larger stones in this gravel are not broken, but remain round, they move the more easily, and even if broken are continually in a state of movement, especially where no proper foundation exists. In fact, the movement between themselves of the stones actually composing the road accounts for a good deal more dust than is generally realised. This I have often proved by taking out a few stones from the centre of an apparently well-made road and observing them with a magnifying glass. Their edges, which should be quite sharp, present distinct signs of constant friction, proving that they move, if ever so slightly, in their beds. Of course, where a tar binder is employed, the tar, no doubt, on account of its viscosity and natural oiliness, diminishes to a large extent this underground and invisible wear. Hence a new argument for the use of tar for roadmaking. I am quite convinced that the stones composing a road without solid foundations move considerably under heavy traffic. Indeed, it does not take more than an ordinary observant eye to often detect a movement in the surface when the wheel of a heavily-laden cart passes over it. Again, everyone must be aware of the phenomena when a road is being steam or motor rolled. As soon as the roller has passed, the road can actually be seen to rebound, as if it was resilient. When the road has, however, eventually settled down, this movement is, of course, not, as a rule, noticeable to the eye, but it still exists; and this movement is much greater and more destructive where there are no foundations. Another advantage of a good broken stone foundation, the pieces of which, in passing, it may be observed, should not be less than 3 in. in diameter, is the complete subsoil drainage provided. On the sides of hills water always tends to force its way out even through the strongest surface, whereas if underneath from a depth of 18 in. to 2 ft. there are large stones bedded together firmly, but with plenty of space for water to pass through, the water will then find its way out at the side of the road, where the foundations should be very near the surface.

The fourth chief cause of dust, namely, the passage over the road of rapid mechanical traffic, is thought by many people to be the chief and not a minor cause. It should be realised, however, in considering the dust problem from a scientific as apart from a prejudiced and popular point of view, that the motorcar, on account of its tyres and the rapidity of its movement, though it raises and scatters dust in a greater degree than any other vehicle when going very fast, does far less to create it than is generally imagined. But there is no doubt that on a loosely-made surface a certain amount of the fine particles which act as binding material to the larger stones are in some way sucked up and distributed over the road, causing round-shaped holes quite different in shape to those caused by either horse or horse-drawn traffic. A good deal of the damage done by motorcars is certainly accomplished when the road is wet, for the alternate pushing in and sucking out of water on the surface by the action of the

rubber tyres is deleterious. A rubber-tyred wheel splashing into a puddle of quite insignificant diameter sends the water flying out of it with a speed and force much greater than would be the case with any other vehicle. The result is to make a small puddle into a larger one, and when that puddle becomes large it is more deadly to the surface of the road than would be the case if this fast rubber-tyred traffic were not present, for it enlarges rapidly. But on surfaces which have been treated with tar, or are made of a hard, unyielding material, the motorcar wheel causes practically no damage, and it should produce no appreciable wear compared with steel-tyred wheels. A steel-studded tyre is, however, far more destructive in its effect than an ordinary plain rubber tyre. But as long as dangerously skiddy surfaces exist it would be undesirable to absolutely prohibit the use of a metal-studded tyre.

Finally, it may be safely said that the best method by which the effect of these dust-creating agents can be counteracted is to make the road waterproof, and the cheapest way to make it waterproof is to tar it. If, therefore, it is possible to lay tarred material at the start, that plan is the best of all. But if not, a coating of tar is the next best thing. The complete removal of dust from our roads is from an engineering point of view perfectly practicable, and the only problem now is one of cost.

PAPER 26: BY T. H. YABBICOM, M.INST.C.E., CITY ENGINEER,
BRISTOL.

An exhaustive description of these subjects would far exceed the prescribed limits of this paper, therefore the author will confine his remarks to those experiments that have been carried out under his own superintendence. It must be understood that macadamised roads only are referred to, although paved streets also suffer from dust, and furnish a corollary to the question of preventing dust on macadam roads.

The principal cause of dust is the destruction of the road surface by crushing or attrition. It, therefore, follows that the selection of a suitable stone for the wearing surface is of the first importance. The road stones that the author has found most capable of resisting the heavy weights of traction engines or their loaded trucks and the destructive impact of motor omnibuses, are those of a dense and tough nature rather than the very hard. These last are frequently brittle, and, although capable of showing extraordinary laboratory results, cannot be depended on for wear in comparison with a stone of greater tensile strength. The brittle stone, although very hard, readily crushes into small fragments that eventually become dust. Of course, the inferior sorts of limestones and chalks are quite unsuitable to withstand the pulverising action of the motor wagon or omnibus.

If the surface stones are not held firmly together when laid, the loss due to attrition is very great; therefore binding, or blinding the interstices with some material, always smaller and frequently softer than the stones themselves, is resorted to. Being made into a sort of paste by the addition of water, and so brought to a

surface, it rapidly disintegrates in dry weather by evaporation, and is a fruitful source of dust. It was recognised many years ago that it is necessary to have something to hold the stones from rubbing one against the other, and this evolved the tar-macadam road, which is very successful in dust prevention. Unfortunately, however, limestones and such like seem more suited to the process than siliceous rocks and granites, with the result that it does not appear suited for heavy constant traffic; also trouble has been experienced on those roads where it has not been possible to keep the new work from being travelled over for a sufficient length of time to allow the materials to be properly set.

While engineers are experimenting on the best methods to be adopted in the future for roadmaking, the public demand some temporary remedy; something more effective than merely street watering, with its many disadvantages and indifferent results. For this purpose the author made experiments during the summer of 1907 with both tar and chemicals in solution.

The spring of 1907 had been so wet in the West of England that the roads were not in a condition to receive the applications before the month of June, and even then were not sufficiently dry in many places for the tar to adhere properly. However, during that season 4.34 miles were treated with tar, either by tar spray or by hand painting, and 5.22 miles washed with a chemical in solution. Notwithstanding the drawbacks of the weather the effects were very successful, and quite sufficiently so to warrant a further and extended trial in 1908. In the early part of that year the climatic conditions were much more favourable for a start than in the previous year, and the opportunity was taken advantage of. The palliatives employed were either the application of tar by one of three methods, or of a chemical in solution. The total length of macadam roads to which tar was applied was 50½ miles, while chemicals in solution were applied to 20½ miles.

TAR TREATMENT.

The application was made in one of three ways :

1. By means of a heavy traction machine travelling at the rate of about 2 miles per hour, the tar being sprayed over the surface of the road through nozzles under pressure. As the roads so treated were about 8 or 9 yards wide, the machine was able to cover the whole width of the road in two journeys. Forty-one and a half miles were so covered; 34½ miles of these roads having essentially suburban traffic, while 7 miles in the city district are subject to the heaviest vehicular traffic. Immediately before the tar was sprayed the surface of the road was carefully brushed clean and free from all droppings and fine dust. Directly the tar had been distributed a thin coating of fine, sharp Bideford sand was scattered over the whole, enabling the newly-treated surface to be used almost immediately. This sand is a fine, clean, sharp grit, which does not absorb the tar and thus deprive the road surface of its waterproof coating. The whole expense of the first cleaning, the tar spraying, and the sanding averaged .95d. per yard superficial.

2. By means of a portable hand-spraying machine; this was tried only on roads of light traffic. The machine is of a very

simple character, easily worked by two men, but has the disadvantage of having to be taken to the depôt frequently for refilling or accompanied on the road by an ordinary tar boiler, the latter plan being found the most practical. This little machine sprayed over a mile and a third of the roads of light traffic very successfully, but the force of the tar through the delivery holes is scarcely sufficient to cause as much penetration of the surface of the macadam as is necessary where there is considerable wear and tear. The cost worked out at 58d. per superficial yard.

3. Tar painting by hand labour was again resorted to on 7½ miles of road of average traffic. Far more tar is used in this process, the results are not so even, and the time occupied to cover a piece of road considerable. The cost averaged 1.41d. per superficial yard.

The costs named above mean the total cost for the whole season of the tar treatment by whichever process was adopted.

TREATMENT BY CHEMICALS IN SOLUTION.

The object is to maintain a damp surface by the use of a deliquescent salt. About 20½ miles were so treated. The beneficial results disappeared after intervals of four to six weeks, according to the state of the weather, and had to be renewed. A certain amount of watering was also necessary to keep the surface moist. The costs varied therefore from 3d. to 4d. per superficial yard for the season. Chemicals were chiefly valuable on steep gradients where it would not have been safe to have used tar.

The dust nuisance was reduced to a minimum during the whole season by one application of tar; at the same time it was not possible to do away with the watercart altogether on the treated roads, for dust accumulates on the surface and in the channels from a variety of sources other than the disintegration of the macadam by traffic, and has to be dealt with. One advantage of such a surface as is produced by the thin layer of tar is to enable the dust that does accumulate to be easily removed, or its tendency to blow about minimised by a very slight sprinkling of water in the early morning.

One season differs so much from another that it is almost impossible to make a comparison in figures of the amount of watering saved by the treatment. One fact, however, is significant. In the residential district of Clifton, which is essentially one of macadam roads, and where nearly one-half of the total mileage of treatment was carried out, the average number of watercarts in use daily during the summer of 1906, before any treatment was tried, was 25, and the quantity of water distributed 13,349,000 gallons, 1906 having been a moderately dry summer. The summer of 1907 was wet, or showery, and therefore not useful for the purposes of comparison, but the summer of 1908 was again dry. The effect of the treatment was that only a daily average of 15 watercarts were required on all classes of roads in the Clifton district, including the untreated as well as the treated roads, and the consumption of water fell to 7,926,000 gallons. Thus in this one district alone the cost of the water and the distribution was reduced by £862.

The cleansing of the roads treated with tar was effected in a much more satisfactory and thorough manner than was possible

in other cases. It is not, however, in dry weather only that the advantage of the treatment has been felt, for during wet weather no mud worked up, the roadways being almost as passable for pedestrians as the footways. Of course, no saving could be expected on cleansing where chemicals were employed, the very means by which the dust is prevented being the continued dampness of the surface.

The actual saving in repairs to the roads due to the use of tar is very difficult to be represented in money on any particular year, as there are such a variety of circumstances influencing the question. One fact may be noted—namely, that the quantity of hard stones, granites, etc., sent from one wharf in Bristol amounted in 1906 to 9,127 tons; in 1907 to 9,417 tons; while in nine months of 1908 only 4,000 tons were weighed out, giving an average for the year of 5,333 tons. The repairs in 1908, to roads that were in first-class condition before tarring, have been practically confined to small patchings with tarred macadam. In one district no repairs have been necessary to any tar-sprayed road during the season except where trenches have been opened. From a very careful consideration of the present condition of the roads, and of the opinions of the district surveyors in charge of the roads, the author is of opinion that the treatment with tar will effect an ultimate saving of from 20 to 25 per cent. of the cost of repairs.

It has been abundantly proved that tar, wherever it has been put and in whichever manner it has been employed, has effectually attained the object of dust prevention; also that the chemical treatment produced the desired end, though in a less degree.

That the treatment has not been unduly expensive is shown by the total cost of all the processes having amounted to £3,468 on 71 miles of roads. When the roads were watered by contract the schedule price for the distribution of water on this length would have been £4,118, not including the cost of the water. The cleansing has been done in a more thorough and systematic manner on the roads treated with tar than is possible on the others. The necessary repairs have been much less frequent, and may reasonably be expected to show a valuable reduction on an extended term of years. The lasting effects have varied much according to the amount of traffic on the roads. Where that has been heavy and continuous very little or no remains of the treatment was to be seen by Christmas. On suburban roads the good effects are still evident in the more rapid drying of the surfaces of the treated roads than of those not tarred, the result being less mud to be removed, and consequently less deterioration. In many roads where the traffic has worn away the tar from the centre the sides still maintain their good surface.

It has been only by a fairly extended trial that an average of results has been obtained. Circumstances vary much, and so do the effects. The direction of the road on the points of the compass, and whether it is open to sun and air or shaded, are material factors. The following points should, however, have consideration. The road surface should be in good repair and properly graded. The surface should not have been repaired immediately before the treatment. The surface should be quite clean and free from any loose grit or fine dust. The road should be quite dry before the tar is applied. If the work is done in hot weather the tar does not come away in a thin skin, as is the case

when the road is cold. Gritting the surface enables the road to be used very quickly after treatment. If possible, the tar should be standardised, as uncertainty of results are the effects of different qualities, and the tars produced from various coals are unlike chemically and in their effects. The tar should be applied in a very hot state. A combination of all the above points will produce the best results, but as circumstances are generally against such a happy state of things one has to put up with the best that one can get, and then very favourable results may be obtained with care and attention.

DISCUSSION.

The CHAIRMAN, in opening the proceedings, said the dust problem was one of the most important in considering the question of the roads, and anyone who could find a solution of the difficulty, either by construction of the road or by preventives, would earn gratitude from owners of motors, residents on the roads, or users of the roads. Their meeting that day had certainly received a very considerable additional interest from the announcement of the Chancellor of the Exchequer in the introduction of the Budget. The Chancellor proposed to meet the expressed wishes of a very large section of the community who had been urging for many years that the question of the roads should be taken up. The right hon. gentleman proposed to establish a road authority and to vest in that authority full powers to deal with the roads in conjunction with, and with the assistance of, the local authorities, and not in any way in opposition to them. They would work entirely in harmony with them for the improvement of the main portions of the roads in such a way as they might think fit. To do that he proposed to set aside from the National Exchequer an annual grant of about £600,000. It was not quite clear whether that grant would be increased from year to year as the taxation of motorcars and petrol was received, or whether it was to be a fixed sum. A Bill would have to be introduced for the purpose, and he urged them to give close and careful attention to that Bill when introduced in order to see that all their interests were absolutely protected. With regard to the constitution of the authority, he believed it was to be a very small one, and not a large one; probably it would be confined to about three members, but whoever was appointed the head of the authority would, he hoped and believed, be a gentleman who would meet with the approval both of local authorities and the public generally.

Mr. DRYLAND, being called upon to speak on his paper, said he was glad of the opportunity of being able to deal

somewhat longer with a few of the points raised in it, because the limit of the paper was rather a small one. Taking the main points of the paper, he did not think he need dwell on the question of dust on roads from causes that could not be avoided, because they could do nothing for that but scavenge and water. The next point he raised was in regard to the dust made by motor vehicles. It seemed to him somewhat futile to contend that the motorcar was not a dust-creating implement, inasmuch as anybody who went about the country saw ruts cut in the road and material thrown out of these ruts which must become dust by the passage of traffic over them. It might be that motorcars themselves did not crush a lot of that material to dust, but, at any rate, they made it in a condition in which it was crushed to dust by other kinds of traffic. In regard to raising dust, he thought they must have noticed there were certain things which raised dust, and his opinion was that it was largely due to the low body of the car and also to its shape. He could not help thinking that efforts should be made by the makers of motorcars to remedy that to some extent; at any rate, by having larger wheels and higher bodies. It was said that to have larger wheels would be more expensive. Perhaps it would at first, but the wear and tear on the larger wheels would not be so great as on the smaller ones, and certainly the wear and tear on the roads would not be so great. He did not think it was a fair position to take up, that because it would be rather more costly the matter should not be tackled. It was not fair to put an implement on the road which was destructive. Some regard ought to be had to the road as well as to the vehicle, and some regard ought also to be had to the ratepayer as well as the owner of the motorcar. In regard to steel studs, he believed there was an absolute concurrence of opinion that they ought in some way to be abolished. It was not fair to the road to put on it a scarifier travelling at great speed and impelled by great horse-power, and it ought not to be beyond the resources of the motor trade to find some kind of tyre which would avoid skidding without unduly injuring the road. He believed there were some tyres on the market which could be said to fulfil that purpose, and he went so far as to say that legislation ought to be introduced to prevent studded tyres and chains also. In regard to the question of binding materials, he was glad to see that there was a process going on of improvement in that respect—he alluded to water binding. There was no doubt they wanted something better than the ordinary crude tar which they got from the gasworks. His own idea was that they needed something more tenacious and less affected by the weather than ordinary tar. If they could get some solution of mineral asphalt in part or wholly, probably that would be the form that binding would take. He believed in the future they would work upon the idea of tar-macadamised roads. For the heaviest traffic tar macadam

was not suitable or good enough, and they would have to go either to wood, granite setts, or asphalt paving, and more particularly would they have to go to those materials for the purpose of maintaining an even surface.

Mr. STILGOE (Birmingham) said they were much better able to deal with dust in the towns than on the country roads, because they had already, before the advent of cars, used water in cleansing, not only for the purpose of preserving the surface of the roads but ensuring the convenience of residents. The towns were better able to bear the cost, and that was practically at the bottom of it. But dealing with dust on the country roads was a very serious matter, because the rateable value was not sufficient to cope with the cost. On the main roads the thing was different, but there was undoubtedly insufficient money, as taxes were at the present time levied, to deal with what one might call the rural roads other than main roads. A great many of them were in very bad condition and not suitable for tarring as they stood, and the advantages to be derived were not so great as they were on the main roads. They would all agree with the writer of the paper as to the desirability of doing away with steel studs and chains on the wheels as soon as something could be found which would give the wheels a proper grip on the road. The tar had been spoken of in a very comprehensive manner, but he did not think the opinion of road engineers was voiced in the statement that tar applied by hand was more tenacious than when laid on by machinery. He was of opinion that when the tar was applied under pressure it had a much more searching effect.

Colonel DIXON (Cheshire) regarded dust as a most important question. It was caused in his county by the light motorcars going through the districts. In their villages they were "inundated" with dust, and the nuisance had become so great that they were most anxious something should be done. In Cheshire they put down the best materials, and they also had brushes used by horse power, but when motors went along everything was covered with dust. What he would like to see established was that light motors should be forced to go through villages at a lower speed than they did at present. In villages he had gone through in Scotland there was a speed limit of 10 miles, and by that they avoided danger, and there was no dust at all. He would like to see that established in England much more largely than it was at present.

Sir J. MACDONALD (Royal Automobile Club) said they had in Scotland the limit of 10 miles an hour in villages. It worked extremely well, and it necessarily had the result that people were not so keen about the question whether they were going 20 or 22 miles an hour in the open country so long as they found that in populous places by going 10 miles an hour they relieved anxiety. There was no doubt that the next generation of children and the next generation of dogs would learn from their respective puppyhoods to take greater care of

themselves than they at present did. He was certain that the limit in Scotland in populous districts had had a good effect. If they made their roads up of the mixture as at present used, they would never get rid of dust. Another cause of the disintegration of the road was road-rolling.

Mr. RATHBONE (Liverpool) stated, as to the action of motorcars on the roads, that he had continually noticed that on the straight there was practically no disintegration in any weather from them, but on a corner just at a turning the road began to be picked up, especially when studded tyres were used. When the road was in good condition he had failed to detect any deleterious effect from motorcars. He agreed that it was the horse that was largely concerned in the picking up of the roads.

The Rev. D. OWEN (vicar of Alltmawr, Builth) had come to London specially to indulge in the pleasure of telling them that they were all wrong in regard to the causes of dust being raised. He had studied the causes. Gripping, suction, and stamping were not the causes. Could any gentleman think of a fourth cause? (A voice: Earthquakes!) He had taken out two patents, and there was a fourth cause which was stated in one of them. He had noticed that there was a cloud of dust which was behind the wheel, and it was the rapid revolution of the wheel that drove the air back. It was the air that raised the dust.

Mr. E. WILLIS (Chiswick) remarked that even when a road in his district was washed and cleansed in the morning there was a considerable amount of dust in the afternoon. He thought there was something in the wear of the slag.

Colonel R. E. CROMPTON said he was closely in agreement with Lord Montagu's paper, and Mr. Yabbi-com's he regarded as of extreme importance. He was not wholly in agreement with Mr. Dryland. It was true the chain marked the soft material lying on the top of the road, but it was not true that it marked the road itself.

Mr. HARPUR (Cardiff) thought the days had gone by for the crying down of the motor traffic, and it was for them to try and find a remedy to meet that traffic. They ought to congratulate themselves upon the proposal in the Budget that road authorities were to get something from the National Exchequer to meet this increasing traffic.

Sir A. BUCHAN-HEPBURN (County Councils Association of Scotland) maintained that if the 10-mile limit were generally applied in villages, much of the complaint about dust in residential districts would be to a large extent obviated.

Mr. R. J. THOMAS (Bucks) thought the problem might be divided into two parts—town treatment and country treatment. Confining his remarks to the latter, he agreed with Mr. Dryland that hand-painted roads, if done properly, were very effective. By tar painting the roads throughout the year for each year they saved £100,000, and it cost them £685,000. It seemed to him that that was the cheapest possible mode of

preparing their roads at the present day for motor traffic. The suggestion of a comparison between the traffic on a motor road pure and simple and a road used by vehicular traffic would not quite answer present-day purposes. They wanted reciprocity, and that the makers of motorcars should do everything they could to reduce the injury done by motorcars.

Mr. COWAN (Local Government Board of Ireland) declared that the great difficulty about dust was in regard to country roads. He had been struck with the magnificence of the streets of London, which were of great credit to the engineers in charge of them. What he liked best in the statement of the Chancellor of the Exchequer concerning their interests was that he was going to remove the sore feeling between the local ratepayers and the users of motorcars. Good feeling already existed, but if the right hon. gentleman's views were carried out he believed that good feeling would be still further increased. In his (the speaker's) opinion, they wanted much more attention to the A B C of roadmaking than was now given. It was not really sufficiently understood by anybody, and one of the most important things this Congress should do would be to insist that skill, care, and uniformity should be much more considered in connection with roads than it was at present.

Mr. F. LATHAM (Penzance) held that on the question of the construction of roads they should consider the thickness of the materials applied. He thought the majority of surveyors applied the material in too thin a coat. He commented upon the advantageous use of calcium chloride upon the roads.

Mr. H. T. WAKELAM (Middlesex) proposed to confine his remarks entirely to the question of tar painting, and to give the results of his experiments during the last five or six years. He believed he was one of the first to adopt tar painting as a palliative for dust, and he was glad to say they had had complete success in the methods employed. They started tar painting by hand, and the results proved in three or four years that they had something which was going to save a large percentage of material in regard to the upkeep of the road; they would prove that there was now a saving of one sheet of metalling in four. Experience had shown that hand painting was far and above any other method, and if they resorted to any other they would get that which was very costly, and something which would add enormously to the roads bill of the country. For motorcars, as a palliative at relatively small cost there was nothing, in his opinion, that could equal tar painting by hand, but the climatic conditions of the country would not admit of tar painting being done by hand to a great extent, and the next thing he had found was the spreading by horse machines. It was not so satisfactory as hand painting, but they got a life very much longer from horse-machine painting than they did from painting by mechanical spreaders. They were so satisfied in Middlesex with tar painting that this

year they had sent circulars to the urban authorities on the subject.

Mr. FRANK (Ripon) having spoken,

Lord MONTAGU replied to the points raised on his paper. He, for one, was entirely in favour of the reduction of speed by legal methods of motorcars through villages. He had always maintained that there was no real hardship in that, but he thought very often that what was a suitable reduction of speed in one particular village was not necessarily suitable for another. There were villages where 10 miles was too fast, and there were other villages with wide streets and very little traffic where 15 miles was not too fast. Therefore, they did not want a hard-and-fast limit of speed, but they wanted a speed limit which should be adjustable, applicable, and suitable. He had found in the county of Hampshire that one of the most effective ways of getting drivers to reduce their speeds through villages was to put up a small notice with these words: "Please drive slowly through the village." It seemed to have more effect on them than a triangle, and appealed to their better nature. It had been found unusually successful in the Hampshire villages. He wanted to correct a slip in his paper on one point. He had used the words "traction engines," and he referred to them as an example of a regulation affecting width of wheel. He meant steam lorries and motor lorries. One or two surveyors had instanced tracks as being very destructive to the road. He entirely endorsed that, and he had done what he could by writing and speech to discourage people following in the same track. Another speaker had referred to the bounding or leaping action of motorcars at high speed. He doubted very much whether that was the case as much as was thought. He had noticed, however, in France, where the road was really level and with no ridges and furrows, that there was no bounding. He agreed that it would be better if the chassis of cars were higher.

SECTION B.

CONTRIBUTIONS OF MOTORS TO IMPERIAL AND LOCAL TAXATION.

CHAIRMAN :

SIR A. BUCHAN-HEPBURN, BART.

SECRETARY :

T. MUNRO.

TECHNICAL SECRETARY :

E. PURNELL HOOLEY.

Papers 35 and 40 were taken as read, as follows :

PAPER 35 : BY SIR HICKMAN B. BACON, BART., LINDSEY COUNTY COUNCIL.

In treating the subject of this paper, it appears desirable to touch briefly upon the history of roads generally in this country, and of the traffic which in the past they have had to carry. The reason for this is the contention advanced, with some plausibility, against any substantial charge being placed upon those by whom the roads are most used, on the ground that the highways generally have always been free to everybody, and that highway maintenance has always been a specially local charge attaching mainly to the occupation or ownership of real property. These assertions may be justified with regard to the highways as they existed in the Middle Ages, when everybody had to travel on horseback or on foot, and the use of carriages was prohibited. It is, however, the fact that ever since the gradual reintroduction of carriages—*i.e.*, during the past three or four centuries—their use upon the public roads has been subject to continual legislative restrictions, both as to the character of the vehicles themselves and as to the conditions upon which they might be used.

Moreover, the character and cost of road maintenance in the past is really not comparable with that of an arterial road suitable for heavy or rapid motor traffic of the present day. It is submitted, therefore, that as present requirements differ from those of the past, so also must the means of meeting them differ.

In dealing with motor traffic under present conditions it seems essential to divide it into, at least, two classes : firstly, what may be termed local traffic ; and secondly, what may be described as passing or touring traffic.

The first-named class should comprise traffic by vehicles within a radius of, say, 12 miles from the residence of the user. Beyond this distance horse-drawn carriages do not commonly travel, but

within a limit of this kind there seems no justification for differentiating between traffic by vehicles of similar character, whether drawn by horses or propelled by machinery; moreover, the traffic which is limited to any particular locality does not necessarily impose any undue burden upon the ratepayers concerned.

At present, taxation is levied upon motor vehicles mainly according to their weight, but no attempt is made to differentiate between vehicles that are driven long distances, perhaps daily, and those which are used infrequently or exclusively for short journeys, such as are within the scope of similar horse-drawn carriages.

Suggestions have been made for the further taxation of motor-cars on the basis of weight and on that of engine power. It has also been proposed to levy a tax on petrol and on rubber tyres. In the application of either of these proposals there are, however, serious practical difficulties, though, in theory, a tax on tyres would certainly be more equitable than any other that can be proposed.

The scheme herein submitted aims at placing additional taxation, not upon the vehicle itself, but upon its use for travelling beyond the neighbourhood within which the user resides and presumably pays rates. It aims, also, at simplicity, and the use of machinery already at the disposal of local licensing authorities.

It is proposed that there should be two classes of licences to drive motor vehicles—viz., the driving licence to be charged at, say, 5s. per annum, and the touring licence at a considerably higher rate.

The driving licence would be non-transferable, and issued in the same manner as at present, but it should expire on Dec. 31st, irrespective of the date of its issue. The holder of a driving licence should be entitled to drive upon any highway within a radius of, say, 12 miles of his residence, as stated upon the licence, but no further. In case of removal, the licence to be void until the holder's new address shall have been officially substituted, for which a charge of, say, 2s. 6d. might be imposed.

The touring licence should be issued in the same manner as the driving licence, but only as supplementary to it. Whenever issued after Sept. 30th, it should be charged at half price, as are carriage licences; but it should always expire on Dec. 31st. In the case of a servant, the licence should be issued on the application of the employer, and be made transferable at his request, as are licences to kill game when issued for gamekeepers. The holder of a touring licence should be entitled to drive upon any highway within the area to which his licence may extend, but not beyond it.

Separate touring licences should be issued for (1) England and Wales, (2) Scotland, (3) Ireland. The proceeds (less 5 per cent. to be retained by the issuing authority) for office expenses to be remitted direct to the Local Government Board in London, Edinburgh, or Dublin, as the case may be.

It is suggested there might be two classes of touring licences, at any rate in England and Wales—viz., a full (or national) licence, and a limited (or county) licence, the latter to be charged at, say, half price of the former, and to entitle the holder to drive within the county where he resides, and within any other county actually contiguous therewith.

It is also suggested that any holder of a touring licence ordinarily resident in Ireland, or elsewhere beyond the sea, should be charged a reduced (say half) price for a touring licence in England and Wales, or in Scotland; and there should be a similar reduction in the case of a licence holder in England and Wales, or in Scotland, taking out a licence for touring in Ireland.

The charge suggested for a full touring licence to drive a motor-car in England and Wales is £6. 6s., in Scotland £3. 3s., and in Ireland £3. 3s., and to drive a motor cycle in England and Wales £2. 2s., in Scotland £1. 1s., and in Ireland £1. 1s.

The nett proceeds to be administered, in each case, by the respective Local Government Boards in subsidising the maintenance of arterial roads within their jurisdiction; these roads being selected with special regard to the incidence of touring or passing traffic thereon, and to the degree of accommodation provided for such traffic by the local authorities responsible for their maintenance.

PAPER 40 : BY EARL RUSSELL.

One of the statements which is most frequently made by farmers and others opposed to modern modes of progress is to the effect that it is a monstrous thing that motorists should spoil the roads and have the sole use of them, when they contribute nothing to their upkeep. This statement, or statements of a similar character, with a hazy belief in their truth, have spread upwards from farmers' ordinaries to Rural District Councils, to some of the less enlightened County Councils, and have even been made within the sacred walls of the House of Commons. In a rash moment I undertook to contribute a paper to this Congress, the object of which should be to demonstrate from actual statistics the entire falsity of such a charge. Immediately I came to grips with the subject I found that no statistics exist which can be drawn upon for the purpose of either establishing or confuting this contention, and that a proper and exhaustive treatment of the subject would involve an original research, likely to extend over from three to five years. The amount of leisure at my disposal, and the rapid approach of the Congress, rendered any such research out of the question. I cannot, therefore, in this paper profess to do more than to indicate the sort of question that is to be dealt with, and to leave it to some more capable hand to furnish reliable statistics in some future year.

On the particular contention, I think it must be admitted as a matter of general knowledge that the man who keeps a motorcar is more or less in the position of the man who can afford to keep a carriage and pair, and he will, therefore, assuming that he occupies a house in accordance with his social station, come rather high up on the list of rateable values. *Prima facie*, there would seem, then, to be every reason to believe that the motorist, as a rule, makes a larger contribution to rates and taxes than is made by eight or nine tenths of the population. In addition to this, he makes certain special contributions which are peculiar to his form of vehicle. Complaints as to damage to the road are generally levelled against the heavy and powerful motorcar. Such a car pays £4. 4s. per annum as carriage licence, 5s. per annum for the master's driving licence, and another 5s. for the

man's, 15s. per annum male servant's licence; and £1 as a registration fee perhaps once in every four years. This makes a special and direct contribution to taxation of £5. 14s. The whole of these licence duties, although they are, in fact, taxes, go to the local authorities, and under the system brought into force this year are actually collected by the local authorities.

Now, although there are no data of a comprehensive character available, certain figures exist from which it will be interesting to quote, subject always to the warning that they must be accepted with caution as incomplete, and not necessarily representative. These are figures which were collected at considerable labour and expense by a joint committee of automobilists to lay before the Royal Commission on Motorcars. They are incomplete, in so far as, being entirely voluntary, it may be probably taken that only the better class of motorcar owner took the trouble to furnish them; but the replies are sufficiently numerous to enable some sort of average to be obtained. The date of the information is 1905. Replies were received from 2,732 motorists, whose cars were of an average value of £374, and travelled annually a total mileage of 44,352,312 miles, with a total of 16 fatal accidents. The number of cars used for pleasure was 1,019; for business and general purposes, 1,169; and for general carriage work, 544. In considering these figures, it is probable that since 1905 the proportion used for business and ordinary country house purposes, as opposed to cars used solely for pleasure, has enormously increased. Instead of being about even, the figures would now probably be at least two to one. It will also probably be true that the average value of cars has largely decreased for two reasons: first, the reduction in the price of the cars themselves; and secondly, the tendency to use cars of smaller power. The proportion of fatal accidents is one in every 2½ million miles. Even allowing that the class associated with the Royal Automobile Club and the Motor Union, from whom these figures were derived, is a specially good class, it may probably be taken that the average number of fatal accidents last year does not exceed one in every two million car miles.

Unfortunately, this general return includes no figures as to the rateable value, but a special return was also obtained from doctors using cars. 1,338 doctors made a return, giving the average value of their cars as £188, and the average rates paid in every 12 months as £23. Drawing the best inference possible from these necessarily limited figures, it is fair to assume that the average motorist would be rated considerably higher than the average doctor. What exactly the figure should be is a matter on which I invite expert criticism, but I suggest with some confidence that the average rates paid by a motorist would not be less than £40 per annum. When it is remembered that among motorists are included the Dukes of Westminster, Bedford, Northumberland, Norfolk, and Richmond, it will be seen that there are superior limits of rateable value capable of considerably increasing the average. The doctor, using a smaller car, will pay £3. 12s. per annum in special taxes, as against the figure of £5. 14s. On the other hand, no account has yet been taken of the amount paid in ordinary taxation by motorists; and when we recollect the income tax, the inhabited house duty, and the taxes on alcohol and tobacco, it will be seen that this figure must be a large one, although it is impossible to approximate it with any certainty.

I venture to think that the foregoing considerations, although based upon insufficient and inadequate data, are still enough to establish beyond any reasonable doubt the proposition that the motorist contributes at least his fair share to both the taxes and the rates of his country.

There is, however, a matter of principle which seems to me to make all these discussions superfluous—a principle which in these discussions is almost invariably lost sight of. I refer to the general underlying principle of both taxation and rating in this country. A man is taxed to support the administration of the criminal law and the police, the judges of the High Court and of the County Court, as part of the civilisation of which he is a member, quite irrespective of the frequency with which he makes use of his opportunities. A man is taxed, and very heavily taxed, for the defence of his country, on the ground that such defence is a national and universal benefit. A man is rated for the lighting and policing of his neighbourhood and the cleaning of his streets, and no one has yet ventured to suggest that he should be excused rates on the ground that he keeps his own watchman on the premises, or that he uses the tube railway instead of the streets. There was a time, before the abolition of turnpike trustees and toll-gates, when the less communistic view prevailed, that the persons who used the roads should pay for them—a phrase that has raised its head again of late. But the view taken by all enlightened administrations in all countries is no longer bounded by these parochial limitations; roads are now regarded as a communal and national asset, and as such to be paid for by all classes of the community. The real basis of the outcry is to be found in what is an undoubted hardship under our present system of road administration—viz., the undue burden laid upon small communities which have to maintain a length of main road that is of no particular use to them. Some poor county or district which has some three miles of main road going through it, and which sees that main road used almost exclusively by long-distance traffic, or, as may be often seen in Staffordshire, by traffic between two towns outside the particular rateable area, may well be excused if it feels that it suffers hardship. There is, I admit fully, a hardship and an injustice in this aspect of the case which is inseparable from our present system, but the remedy I would suggest is in the adoption of something corresponding to the French system, and in making all important through routes a national charge. If this were done, the particular injustice and hardship would cease, the main roads would be more creditable than they are to this rich country, and they would be kept up at a less expense by persons more competent to perform the work than some of the surveyors employed by the smaller local authorities. The remedy is not to be found in returning to the exploded system of taxing the actual wheels that pass over the road surface, and the enemies of motors will not be well advised to press this contention too far. If those who use the roads and those who destroy the roads are to pay for them, it may well be found as the result of a scientific inquiry that the tax will fall with overwhelming weight upon the horse-drawn vehicles, which seem now to flatter themselves that they have some exclusive right to destroy the roads uncriticised.

DISCUSSION.

The CHAIRMAN said in regard to the conduct of the meeting that he proposed, subject to approval, that the writers of papers, if they wished, should add any further remarks, and then should have a right to reply to criticisms elicited. Of course, the situation was a little bit changed to-day owing to the Budget, and in view of that Sir Hickman Bacon had suggested that the meeting might think his paper unnecessary. But he was of opinion, and there seemed to be general agreement, that it would be a great pity if the paper was not discussed, because many points might arise in the course of the discussion which might be of interest in the future. He was sorry that Sir E. Strachey was not in the chair; he had had to change with him for another meeting, and had to be present in the House of Commons. Had he been present they might have obtained, perhaps, some first-hand information which they were not in a position to have now, and it might have been elicited from him what some of the propositions meant. It was very difficult to know what it amounted to beyond the fact of there being a central authority who were going to deal with this sum of money for the assistance of roads, but how far it was to be expended on new roads or how far on the upkeep of existing roads was a matter which was apparently an open point. He was there in a judicial character, and, therefore, he would not make any remarks criticising the papers in any way; but he would like to call attention to one point which he thought it right that the members present should be in possession of, and that was in regard to Lord Russell's paper. It was really dealing entirely with the situation in England. He made a calculation of the amount of £5. 14s. taxation that the motorist supplied; as a matter of fact, that sum of money was not obtainable by them in Scotland. All they got was £1. 10s., and the whole of that was the motor licence and the licence of the driver. If they drove themselves, it was only £1. 10s. All the rest of the money, including fines, went to the Imperial Exchequer. The argument based on that figure would have to be confined to England, and not extended to Scotland. He did not know what the duties were in England.

Sir H. B. BACON: The same as in Scotland.

Earl RUSSELL said he understood that this Conference was dealing with England alone. He certainly understood that the carriage licence applied in Scotland, although not in Ireland. With regard to the general situation, he saw no reason to alter a single word of what he had expressed, and he must wait and see what happened.

Lord MONTAGU said he would like to say a few words to

initiate the discussion. Without touching on the subject of the new arrangements of the Chancellor of the Exchequer respecting petrol and motor cars, he noticed that Sir Hickman Bacon alluded to the possibility of a tax on petrol and rubber tyres, and in regard to that some six months ago he (the speaker) made an interesting calculation as to the amount that would be produced by such a tax, and the effect of taxing petrol and motor cars and other engines that used it. He was not speaking of the justice or injustice of the tax or its desirability, but he thought the effect of taxing petrol would probably be to tend to make people use petroleum instead of petrol, and they would see it used for motive power. That would be less cost to them, but more stink to the public. Excellent as the metropolitan 'buses were, they knew how very much they smelt, and if they got that intensified by a heavy tax on petrol, the result would be that, although they would collect more money, they would have more stink. Then, again, on the basis of 40 million gallons, which was the consumption of petrol last year, 1d. per gallon produced, roughly, in Great Britain £175,000 as duty; but it must be recollected that out of that amount at least one-third—some people calculated even a larger proportion—was used in the dyeing trades, and other trades used petrol for cleansing purposes. Sir Hickman Bacon suggested how they might limit the scope of irresponsible drivers, and he was very optimistic—more than he himself was. He thought that if a man was irresponsible in character, he would always remain so. A leopard could not change his spots, and a man who was naturally reckless and inconsiderate in character would be indifferent to any laws that were made. He was afraid that no amount of regulation, short of the power to suspend his licence, would have any effect. It was hardly, perhaps, in order or advisable to discuss the question of the licences now at great length, because it would all come to a question of motorcar taxation; but he agreed with Sir Hickman Bacon that if it had not been for the proposals of the Budget it would have been perfectly fair to raise the charge for a licence. Personally, he would prefer to see a higher charge for the licence and not so high a tax on petrol or the motorcar, as suggested. If they taxed the individual, they would not have so many people taking out licences who were not really fit to drive cars.

The CHAIRMAN suggested that it would be advisable, and would lead a wider discussion on the papers, if they were considered and discussed together.

Lord BELPER remarked that no doubt their proceedings that day had been somewhat modified, and the ground had been cut from under their feet by the statement made by the Chancellor of the Exchequer as to the fund he was going to provide by the duty on petrol per gallon and the motorcar tax. It certainly, at first sight, appeared that at last the local authorities, who had been put to a very great expense

in trying—not altogether successfully—to keep their roads up to the mark for motor traffic, were going to have some return made to them in the shape of these duties, which were to be set aside for the purpose; but on reading further what Mr. Lloyd George said he found that the question was asked him at the end of the proceedings whether he intended that the tax upon petrol, like the tax on motorcars, should go to the support of the roads, or was it intended that it should go to the general Imperial revenue. Mr. Lloyd George replied that with regard to petrol his proposal was that the whole of the money raised, whether by increasing the graduation scale or by the petrol duty, should go to the improvement of the roads. They were not going to the local authorities, but to the central authority, which would spend the whole money upon schemes for the improvement of the roads, which, however, would have direct reference to motor traffic. That was a most extraordinary statement, because, as they were all aware, there was no central authority with regard to roads. At the present moment such a body did not exist, and before it existed they had to decide what roads the central authority had to have control of and what roads, therefore, the local authority that kept them now would be relieved of. What seemed to him extremely important was whether at a conference of this sort they should not pass some resolution asking, at all events, for information on this point, or expressly asking that this money should go in some form or other—part of it, at all events—to recoup the local authorities for the great expense they had been put to with regard to the traffic on the road; this was a demand which had been made repeatedly during the last year or two to the Government, which had been never denied, that there should be some larger contribution from the central authority than they had hitherto received. Of course, if one of these taxes went to the local authority, that, so far, would recoup them for the expense on the roads. The difficulty of the situation, so far as the Budget was concerned, was that it appeared on this and other points to contemplate legislation of a totally novel character with regard to a number of matters which had never been put in a concrete form before Parliament, and which the Government had not taken up or made any proposal about. Therefore, the proposals of the Budget could not be carried out until, in the first place, there had been legislation to set up a central authority and decide what the duties of the central authority would have to be and what they would take over and relieve the local authority of. He ventured to put that point before this section of the Conference because it seemed to him it was the moment to try to get some authoritative statement with regard to this matter, and that they might add that in the opinion of the Conference there was a claim, if money was given by the central authority, for some part of that money going, either directly or indirectly, to the relief of the ratepayers, who had

very heavy charges put upon them in consequence of the motor traffic over the roads.

Mr. SEYMOUR WILLIAMS inquired whether it might not be that the explanation of the proposal of Mr. Lloyd George was that the central authority would receive the money and would ask for schemes or suggestions from County Councils or other bodies in control of the roads, or important schemes in their districts towards which they could make the grants. It seemed to him it was to be devoted to the improvement of the roads. He did not gather that a new authority was to be set up charged with the construction and maintenance of the roads, but that there should be some body who would ask the present local authorities to suggest schemes where improvement could be made and make grants in accordance with the purposes. That seemed to him a possible explanation of the whole thing, which at the present moment was certainly most obscure.

Lord BELPER: There is the statement that the money is not going to the local authorities.

Mr. MACHIN (Gloucestershire) suggested that it was possible the Chancellor of the Exchequer, when he talked of this new authority, was bearing in mind that there had already been drafted a Bill for establishing a Highway Committee, and that that was in his mind. If that was not the case, he thought this Conference would strongly deprecate the formation of any independent authority for merely the improvement of the present roads in which the county authorities and the local ratepayers did not take a large part. What he meant was he did not think they wanted any new authority set up to interfere with the local administration of the roads, and anything of that sort should be strongly deprecated. If the ratepayers were going to find the money, let the management be in their hands. The ratepayers had found a vast amount of money for the Education Act, and they knew with what result. The result was that the county authorities and managers were in the hands of the Education Department.

The CHAIRMAN said his attention had been called to a paragraph which appeared to be rather a curious one. Mr. Lloyd George went on to say: "I have already explained to the committee that one of the chief reasons for imposing additional taxation on motorcars is the fact that the increase in their numbers necessitates a reorganisation of our main road system, and it will be obvious that we are not to confine taxation to a mere readjustment of the scale of licence duties. The burden would be imposed with absolutely no relation to the extent that the car might use the roads." That looked rather as if it was going to be a matter of road construction, and not to assist local authorities in the maintenance of their roads. It was mentioned also that money might be expended on making new roads.

Earl RUSSELL explained that he was present during the speech of the Chancellor of the Exchequer, and he thought

he knew what he meant. The intention was to point out that if he merely took the existing licence duties and increased them, he would not be taxing motors in proportion to their use of the roads. He was there adumbrating petrol. As to *the money, the intention was, he thought, perfectly clear*—that was to allow to the local authorities their present proportion of the licence duties, but to take the whole of the surplus into the Exchequer. The Exchequer was then going to distribute it as a matter of grants-in-aid, not for the expense of maintenance of the roads, but for district improvements, such as cutting off corners and making new roads. But he did not gather anything as to the setting up of a central authority. He understood it would be a department of the Treasury. The scheme, as he understood it, was: If the local authority said, "Here is a matter or scheme to be undertaken, and we have not the money," the Chancellor of the Exchequer would say he had the particular nest-egg, that he had earmarked it for the purpose, and he would help them.

Mr. TICKLER (Grimsby) associated himself with the remarks of the last speaker, because he thought some remarks had been made that the local road authorities would not benefit by having the money given to them, and he thought it was quite right they should not have it. It should not be done; they should not be recouped for anything they had done, because, although they had been caused some material expense, yet they had not made any particular improvements to the roads. He took it, from what had fallen from Mr. Lloyd George when he was questioned on the matter, that this money was to be applied to the improvement of the roads and to the better construction of the roads. In his county they had some very narrow roads and some very twisty roads, which was a great inconvenience to the people using them, particularly those who used them for motor traffic; but it must be a very great difficulty to convince the local authorities that it was necessary, and that they should be put to the expense of making roads suitable for motor traffic. He hoped the grant would be given and used in the construction and improvement of roads, straightening them and widening them, and making them more suitable for the requirements of the traffic to-day.

Lord BELPER said he would like to explain that he did not think the point he made had been entirely understood. If these grants were to go to the improvement of the existing roads and making them more convenient for the present traffic, it was quite clear that that would be a relief to the local authority, because they would have a road that would carry the traffic with less wear and tear. His difficulty was that Mr. Lloyd George distinctly said that the grants were not to go to the local authorities. Whatever it might result in, they were very glad to see any assistance given for the purpose of improving the roads, whether it came through the local authority or in any other way.

The CHAIRMAN thought it was very probable that the local authorities would have to make suggestions to the central authority, whatever it was, and that they might allocate sums required. He imagined that was the only way it would work.

Mr. SCOTT PLUMMER (Selkirkshire) said the Chancellor of the Exchequer might have very good reasons for improving the roads at the present time, but he was very hard pressed for money, and when once he had got the money there might be other objects that would absorb a good deal of it. It seemed to him that the amount he estimated he would get from motorcar taxation would go a very small way towards really improving the main roads. It had been stated by one speaker that it would take £600,000 a year merely to put tar on the main roads of England and Wales, and the amount to be given seemed quite inadequate. Lord Russell seemed to think that it was out of date to look to the traffic on the roads to maintain the roads, but it seemed to him that that was really the fairest way in which the roads could be maintained. He did not think it was at all unreasonable to ask that a very considerable share in maintaining the roads—especially if they were much improved—should be borne by the users of the roads.

Sir J. MACDONALD (Royal Automobile Club) observed that one heard surprising things occasionally, and he had heard something surprising from his friend near him; it was that people who used the roads were to pay for them. If everybody who used the roads just now was to stop using the road, what would become of the ratepayer? When it was said that the ratepayers bore a greater share than they ought to bear of the expense of keeping up the roads, surely the question of the roads of a country was either a question for Imperial or local taxation, and it must be paid by some class or another. The old-fashioned system of tolls was proposed. ("No.") The system of tolls was a hopeless system for the purpose of maintaining roads which were wanted throughout the country. In a rich district the roads were kept up, and in a poor district they were not kept up.

Mr. SCOTT PLUMMER denied having advocated a return to tolls. It had only been mentioned as the old way of raising money.

Sir J. MACDONALD said it had been strongly suggested, and the paper of Sir Hickman Bacon began by practically suggesting that. The Chancellor of the Exchequer believed, and all of them seemed to believe, that by putting a little extra tax on automobiles he would raise a sum of half a million. That ought to indicate to people that they were not going to be in the position of being crushed. People must not form the idea that automobilists were to be treated as pariahs, to be ground down by extra taxes. In a very few years automobilists, if they thought proper, would be able to dictate a policy, but he did not think anybody would choose. If they laid a good road, and had nothing on it but india rubber

tyres, either solid or pneumatic, they would not have the road going to pieces as it did now. The automobilists of the country wanted to work pleasantly with everybody else—the police, the road surveyors, the country gentleman, local councils, and everybody; but there were, of course, a few cantankerous and wild individuals, just as he supposed there were on County Councils and even among the police. But those were not the people who would rule the matter, and nothing had struck him more at this Conference, both yesterday and that day, than to see that all bitterness had disappeared out of the discussions, and that there was a tendency all round to try to see what was best to be done. He would say, let the people who had induced the Chancellor of the Exchequer to put on the tax accept that with gratitude, because if he could only keep on that tax they would get a vast deal more from it than half a million; they would probably get $1\frac{1}{2}$ million out of it during the next five years.

Mr. LAMBIE (Lanarkshire) thought they might congratulate themselves that the Chancellor of the Exchequer had adopted a very wise course. He had left vehicles driven by motive power as they were; he had graduated the tax on the horse-power, and that was what some of them had been contending for, and the destruction to the roads by violating the law could be put right. He would like, if a resolution could be come to that afternoon, that if there was to be a central Board they should have some voice in it; the local authorities should have some voice as well as motorists and the Government. They should have got more for the upkeep of the roads from the Imperial Exchequer, and they ought to see that they got their full share. The Chancellor of the Exchequer had done a good thing for them and for the roads, and the motorists had been very generous.

Mr. JENKINS (Glamorgan) urged that if there was to be a central authority, the money ought to be fairly divided among the various authorities. He did not see any difficulty in using the money.

Lord MONTAGU (Royal Automobile Club) said that when they talked about the burden thrown on the ratepayer for the upkeep of the roads some of them forgot that in the amount spent on the upkeep of roads there was a sum granted already. It was misleading to say that it was only the ratepayers who paid for the upkeep. Mr. Lloyd George told them that £600,000 a year was the sum he hoped would be available out of the new taxation. If they divided 28,000 miles of main roads in England and Scotland—which was the present mileage—it gave £21. 8s. per mile as a yearly grant for improvement and maintenance. As a beginning it was really a substantial sum. It had been said that the motorists had indirectly been the cause of the improvement of the roads. Of course, that was a point which as motorists they had always maintained; but a road was meant to be used, and not to be looked at. He thought that they, the

road users, had given the best testimony to the roadmakers. They appreciated a good road in a manner that no other people appreciated it.

Sir HICKMAN BACON, in replying to the points raised on his paper, expressed doubt whether the taxation put upon motorists, if it once got into the Treasury, would ever go to the roads. His proposal was that the money should go through the County Councils and boroughs to the Local Government Board, and should never get into the Treasury at all. If it got into the Treasury, it would probably go to old-age pensions or some other scheme.

Earl RUSSELL, also replying, said his main contention in his paper was to the effect that the motorist did at present contribute not only his fair share but his full share to the taxation and to the rates of the country. That had not been controverted in this discussion, and he, therefore, took it that it was generally assented to by this meeting. He ventured to say that the proposal that those who used the roads should pay for them was an exploded principle. Tolls were abolished not so long ago, and it was done because it was considered that means of communication should be free to all without taxation. If in the minds of the local authorities the particular class that was pointed out as the payers was the motorists, the latter would probably ask that some inquiry should be made as to who used and damaged the roads, and he had little hesitation in saying that if that inquiry was made by experts on a scientific basis, they would find it was due to other forms of traffic than those who used indiarubber tyres. Nothing that had been said had led him to alter the conviction which he had ventured to express in his paper. The principle, to his mind, was wrong. As regarded the particular tax, he did not view it with equanimity. He thought it was an iniquitous tax in its incidence. The Chancellor of the Exchequer would find that he had cut his own throat. He had been told in regard to spirit duties and things of that sort that he had reached the limits of taxation, and the amount of the tax put upon petrol would defeat its own object. People would keep fewer motorcars or none at all, and would take substitutes for petrol—perhaps, paraffin. Then a cry would come to tax paraffin, and they would find that that was not a desirable object to aim at. He had no good words for the tax. But the sop which had been provided by the Chancellor of the Exchequer was one of such importance that it did over-ride objections which were both of a theoretical and practical character to some extent, and that was the setting up for the first time of some central road fund, administered by a central department—not handed over to the local authorities to spend at their will, but only for specific improvements. If, as he hoped, it was intended to be the beginning of a central highways department, which would turn their existing roads into something like the Routes Nationales of France, he thought that would be of enormous advantage.

THURSDAY, APRIL 29.

SECTION C.

EXCHEQUER GRANTS, NATIONAL ROADS, GOVERNMENT
DEPARTMENT.

CHAIRMAN :
TOMMAN MOSLEY.

SECRETARY :
H. SEYMOUR WILLIAMS.

TECHNICAL SECRETARY :
E. PURNELL HOOLEY.

Papers 1 and 2 were taken as read, as follows :

PAPER 1: BY J. SHUTTLEWORTH, CHAIRMAN OF THE MAIN
ROADS AND BRIDGES COMMITTEE OF THE LANCASHIRE
COUNTY COUNCIL.

The principle of grants from the Exchequer towards the maintenance and improvement of the main roads of the country is now generally accepted as being both desirable and equitable.

The Royal Commission on Local Taxation stated in their report issued in 1901 :

"The maintenance of main roads we also consider, on the whole, to be some extent a national service, and likely to become more so, owing to the increasing mobility of the population and the development of new means of locomotion."

The Commissioners further state in another part of their report that :

"On the facts before us, we think that one half of the expenses of the maintenance of these roads in counties during the financial year preceding legislation on this subject should be paid by the Exchequer."

The development of the new form of traffic has abundantly justified the forecast of the Commissioners, and probably gone considerably beyond anything they anticipated at that time.

The case of the Lancashire County Council (which is perhaps an exceptional one in some points), I think, supplies a strong argument for a larger contribution from the national funds for general application.

In the geographical county (if Stockport, which is partly within Lancashire, is included) there are 18 county boroughs, or nearly one-fourth of the county boroughs in England and Wales.

The relative positions of these county boroughs leaves the administrative county to maintain the lengths of main roads connecting them, these lengths varying from 2 miles to 40 miles, to which the county borough ratepayer does not contribute by rate.

The development of the heavy motorcar (motor wagon) has enabled the most remote of these county boroughs, with one exception (Barrow-in-Furness), to exchange commercial traffic with each of the others by road within a one-day journey, and consequently the main roads of the administrative country are now carrying considerable traffic which would formerly have been conveyed by rail, and this together with the increasing light (or pleasure) motorcar traffic, which uses the county main roads in much larger degree, has caused a greater and still increasing expenditure to be necessary.

Taking Manchester as a centre, and including Manchester and Salford, which are contiguous, we have seven county boroughs within a radius of 12 miles from the Manchester Town Hall—viz. :

| | |
|---|---------|
| Manchester, with an estimated population of | 649,251 |
| Salford do. do. do. | 239,294 |
| Bolton do. do. do. | 185,318 |
| Bury do. do. do. | 58,029 |
| Rochdale do. do. do. | 83,114 |
| Oldham do. do. do. | 142,507 |
| Stockport do. do. do. | 102,339 |

If a radius of 20 miles is taken, there are four other county boroughs—viz. :

| | |
|---|---------|
| Warrington, with an estimated population of | 64,212 |
| St. Helens do. do. do. | 92,500 |
| Wigan do. do. do. | 82,428 |
| Blackburn do. do. do. | 135,278 |

And within a 35 miles radius, five others—viz. :

| | |
|--|---------|
| Liverpool, with an estimated population of | 753,203 |
| Bootle do. do. do. | 69,500 |
| Preston do. do. do. | 117,709 |
| Burnley do. do. do. | 105,000 |
| Southport do. do. do. | 53,318 |

Statistics of traffic have been taken on five of the main roads leading from Manchester to other county boroughs within a radius of 12 miles from Manchester, with the following results.

On the Manchester and Bolton road at a point 7 miles from the Manchester Town Hall :

| | |
|--|-----------------|
| Traffic from county borough to county borough was | 46·56 per cent. |
| From administrative county to county borough or <i>vice versa</i> | 9·95 per cent. |
| Purely administrative county traffic from one point of the county to another | 43·49 per cent. |

On the Manchester and Bury road :

| | |
|---|-----------------|
| Traffic from county borough to county borough | 55·14 per cent. |
| „ from administrative county to county borough or <i>vice versa</i> | 32·98 per cent. |
| Purely administrative county traffic | 11·88 per cent. |

On the Manchester and Stockport road :

| | |
|---|-----------------|
| Traffic from county borough to county borough | 77·95 per cent. |
| „ from county borough to adjoining county or <i>vice versa</i> | 3·67 per cent. |
| Traffic from county borough to administrative county or <i>vice versa</i> | 9·08 per cent. |
| Purely administrative county traffic | 9·30 per cent. |

On the Manchester and Oldham road :

| | |
|--|----------------|
| Traffic from county borough to county borough | 61'5 per cent. |
| „ from county borough to administrative county or <i>vice versa</i> | 27'4 per cent. |
| Purely administrative county traffic | 11'1 per cent. |

On the Manchester and Rochdale road :

| | |
|--|-----------------|
| Traffic from county borough to county borough | 34'55 per cent. |
| „ from county borough to administrative county or <i>vice versa</i> | 23'05 per cent. |
| Purely administrative county traffic | 42'40 per cent. |

The traffic was also taken on the Bolton and Bury road with the following result :

| | |
|---|-----------------------------------|
| From county borough to county borough..... | 40'29 per cent. |
| From county borough to administrative county or <i>vice versa</i> | 45'13 per cent. |
| Purely administrative county traffic | 14'58 per cent. |
| Summarising these statistics on the six roads mentioned, it will be found that the traffic between county borough and county borough varies from..... | |
| | 34'5 per cent. to 77'9 per cent. |
| Traffic which is common both to county borough and administrative county from... | |
| | 9'08 per cent. to 45'13 per cent. |
| And purely administrative county traffic from | |
| | 9'30 per cent. to 43'49 per cent. |

The figures in the foregoing statistics give the number of vehicles passing over the roads, but if the weight had been taken instead the comparison would have shown a still greater percentage of the bulk, as traffic between county borough and county borough, as undoubtedly the latter is largely made up of loads of the heaviest type.

Table A shows the amounts transferred from Exchequer contribution account towards the relief of main road expenditure :

TABLE A.
LANCASHIRE COUNTY COUNCIL. EXCHEQUER CONTRIBUTION.

| Year. | Rateable value of county. | Total main roads expenditure. | Total mileage of main roads. | Amount transferred from Exchequer contribution account in aid of rates. | | Total. |
|-------|---------------------------|-------------------------------|------------------------------|---|-------------------|-----------------------|
| | | | | Main roads. | General purposes. | |
| | £ | £ | | £ | £ | £ |
| 1890 | 8,468,569 | 89,379 | 571 | { 24,554 45,000 } 2 yrs. | 25,400 | 94,954 |
| 1891 | 8,110,313 | 98,451 | 571 | 45,000 | 29,384 | 74,384 |
| 1892 | 8,110,313 | 114,088 | 571 | 55,013 | 32,386 | 87,399 |
| 1893 | 9,144,948 | 121,195 | 571 | 59,729 | 12,596 | 72,325 |
| 1894 | 9,116,398 | 138,573 | 668 | 66,518 | 4,012 | 70,530 |
| 1895 | 9,086,822 | 140,143 | 675 | 53,827 | — | 53,827 |
| 1896 | 8,504,894 | 141,152 | 693 | 64,674 | — | 64,674 |
| 1897 | 8,504,238 | 141,914 | 683 | 57,679 | — | 57,679 |
| 1898 | 9,275,883 | 141,600 | 684 | 69,575 | — | 69,575 |
| 1899 | 9,090,321 | 141,004 | 685 | 70,369 | 142 | 70,511 |
| 1900 | 9,090,321 | 144,374 | 666 | 73,372 | 3,800 | 77,172 |
| 1901 | 9,672,482 | 138,204 | 668 | 63,000 | — | 63,000 |
| 1902 | 9,621,570 | 142,515 | 663 | 59,600 | — | 59,600 |
| 1903 | 9,509,718 | 147,138 | 674 | 53,070 | — | 53,070 |
| 1904 | 9,509,718 | 149,578 | 673 | 49,974 | — | 49,974 |
| 1905 | 8,659,942 | 145,141 | 673 | 45,109 | — | 45,109 |
| 1906 | 9,173,886 | 144,689 | 669 | 51,623 | — | 51,623 |
| 1907 | 8,856,078 | 145,066 | 664 | 50,000 | — | 50,000 |
| 1908 | 8,850,238 | 144,451 | 657 | 49,000 | — | 49,000 |
| 1909 | 8,979,900 | 162,160 (estimated) | 657 | 42,000 (estimated) | — | 42,000 (estimated) |

It will be seen, therefore, that the administrative county rate-payer has a substantial grievance, in that he has to bear the cost of maintaining these main roads which are so largely used by county borough and other through traffic.

Under Sections 21 and 22 of the Local Government Act, 1888, certain funds were provided by the Government in substitution for existing grants, and under Clause 23 it was provided that the balance of the fund, after meeting certain obligatory payments, should be transferred to general purposes account.

It was thought desirable by the Lancashire County Council, however, to vote any available balance directly to the relief of the main road account, and the following resolution was passed by the Council on the 7th of August, 1890:

"That, upon the recommendation of the Finance Committee, the balance of the Exchequer contribution account be appropriated in payment of one-half of the expenditure on the main roads account, and that the general purposes account be credited with any sum which may remain after such payment."

From the foregoing table it will be seen that the rateable value of the administrative county is practically the same to-day as it was in the year 1890, the creation of new county boroughs and the extension of existing county boroughs having absorbed the whole of the increased rateable value which has accrued in the administrative county during the past 20 years.

The various extensions of county boroughs and the new county boroughs have absorbed £2,832,888 of rateable value which was originally part of the administrative county, and unfortunately for the County Council there are further reductions which seem likely to come forward in a comparatively short period.

The rateable value of the geographical county in 1890 was £18,561,534, whilst to-day it is £24,987,028, so that whilst the total increase has been £6,425,494 the administrative county only benefits to the extent of £511,331.

Moreover, the growing rateable value carries with it an additional burden in the way of increased traffic, of which the administrative county has to bear an undue proportion.

It will also be seen that with an increasing expenditure the amount available for transfer from Exchequer contribution account in relief of main roads is gradually decreasing until it barely suffices to provide one-fourth of the expenditure at the present time.

I am of opinion, considering the more extensive use of the main roads which is now being made and the steadily increasing cost of maintenance caused mainly by the new forms of traffic, that it would not be unreasonable to ask the Government to provide a grant which would cover at least one-half the annual expenditure.

PAPER 2: BY R. H. DORMAN, M.INST.C.E., COUNTY SURVEYOR,
ARMAGH.

The author understands the term "national roads" to apply to any road maintained wholly or in part by State aid and wholly or in part under State control, but for the purpose of this paper he proposes that the term should only apply to a main trunk road under these conditions, carrying through traffic.

It is probable that every possible argument for and against a central Government department of highways, with its natural accompaniments, State aid and State control, has been published long before this, the chief arguments brought forward in favour of State aid being briefly as follows :

1. With the advent of motorcars and other mechanically propelled vehicles long-distance travelling by road has increased, and will continue to increase enormously over the main roads, and it is unfair that local bodies who may derive little or no benefit from this traffic should bear the full expense of maintaining the roads over which such traffic is conducted.

2. No system could be devised which would result in a district being rated in exact proportion to the benefit it derived from the traffic passing over the roads within its confines, as well as in proportion to the wear and tear the traffic emanating from it inflicted on the roads in other districts which derived no benefit from such traffic.

3. Even if a system of proportional rating could be devised for each district, it would still not be an equitable system unless each individual was rated in proportion to the traffic he created; but this would be impossible, because traffic is largely a continuous process, passing through many hands and benefiting many people, and it would be impossible to differentiate and tax the individual in proportion to the traffic he creates. To secure, therefore, the nearest possible approach to equity, it is necessary to enlarge the area of taxation, and in the case of through traffic on the roads to place the burden of maintenance on the broad back of the State or the community at large.

4. It is essential that the main roads of a country should be kept up to a uniform and high standard of excellence, but it would be impossible for some poor districts in which heavy through traffic is conducted to levy a rate sufficient for the maintenance of the roads up to this standard, and in such cases extraneous aid is required.

5. As through traffic continues to increase and to become more important from year to year the necessity for improved highways will become more acute. Gradients will have to be eased, diversions will have to be effected, including possibly loop lines round towns and villages; roads will have to be widened, strengthened, re-formed, and materials and a system of maintenance which formerly provided suitable surfaces for local traffic will have to be discarded in favour of more expensive materials and more elaborate and more involved methods of maintenance. But to put the whole cost of providing for such work on the locality would in many cases be obviously unfair.

6. Instead of local bodies experimenting on a small scale on new materials and new methods of application in connection with road maintenance, and having to place themselves to a great extent in the hands of patentees and manufacturers, it would be of universal benefit if experiments were conducted on a large scale under State supervision on some of the most important roads in the country, so that it might be possible for all interested in the subject, with the least inconvenience, to watch the actual experiments carried out, and that full records of such experiments might be published and placed at the disposal of the public.

7. In certain parts of the country near large military stations

the roads frequently suffer a good deal of injury from traction-engine traffic on military service, from heavy gun carriages, etc. ; further, for defensive purposes, good lines of communication, in the shape of strong and well-kept trunk roads, are indispensable, and, where the exigencies of local traffic do not require roads of the highest standard, they should be provided by means of State aid for the protection of the country.

8. The probable issuing of loans for permanent works on easier and cheaper terms than at present.

In favour of State control the following advantages may be adduced :

1. The auditing of the accounts of each Council on similar lines by independent officers, and so free from any bias or local influence, by which the most conscientious officer, if resident in a district, is sometimes unconsciously influenced.

2. The establishment of a central office for the purpose of collecting statistics, initiating and encouraging experimental work, accumulating information, and then recording, distributing, and diffusing the knowledge and information so acquired amongst all bodies connected with road maintenance in the country.

3. The setting up of and the insistence on a uniform standard of excellence for all roads towards the maintenance of which the State contributes.

4. The appointment of officers whose duty it would be to see that this uniform standard of excellence was maintained, failing which the grant-in-aid would be withheld ; to consult with county and other local officers with reference to road diversions, hill-cuttings, widening, and other works towards which special aid might be given ; to conduct experiments on the roads in conjunction with local officers on materials and methods ; and to test, standardise, and determine the relative merits of all materials used for road maintenance purposes.

The objections to State aid, and more particularly to State control, may appear superficial and unimportant to the unobservant, but to those intimately acquainted with local authorities it will be recognised that they cannot be lightly brushed aside. To untrammelled State aid it is improbable that any local authority would object, but the individual taxpayer might, his contention being that he makes little use of the public roads, and therefore he should not be taxed for their maintenance. This assumption cannot, however, carry much weight. The roads of the country are a national asset, and are practically the property of the public. Every man has a free right to the use of the roads by day or night ; so long as he conducts himself and uses a road for its legitimate purpose he cannot be interfered with. Now, there are very few who do not use the roads, and the vast majority of the people in the United Kingdom use them, and are using them, to an increased extent every year, and the general public cannot, therefore, in common fairness, object to a small grant-in-aid being made out of the common purse to the maintenance of the main roads of which they avail themselves so largely.

The chief objections to State aid fettered by State control seem to be :

1. Local bodies are extremely jealous of their powers, and would resent any interference with their administrative powers.

2. It might result in increased apathy and indifference where

such exist on the part of those in authority, instead of stimulating them to extend their efforts.

3. Local officials would object to their work for which they are, in the main responsible being inspected and reported on by Government officers.

4. The difficulty of establishing a central department and obtaining competent and experienced officers to perform the duties attaching to the department.

Dealing briefly with these objections, the author submits :

1. Local bodies should not stand in the way of administrative reform.

2. The popular demand for better roads should prevent such bodies from relaxing their efforts.

3. Officers to local authorities should be free from petty jealousy, and should regard with favour and goodwill any legislation put forward for the betterment of the roads within their district.

4. The establishment of a central department would only be a gradual process, but increasing in importance from year to year, as the demands on the department for the information which it alone could fully supply becomes greater. In the same way the staff could be gradually built up, it being of paramount importance that only highly-trained officers of long practical experience should be appointed to the chief offices of the department.

Having summarised the arguments in favour of and against State aid and State control, the author will proceed to enumerate the views he has ultimately arrived at relative to the subject of national roads and the establishment of a central Government department for management or inspection in his own country.

In order to obtain the best results both as regards efficiency and economy and uniformity in matters of road maintenance in Ireland without interfering with the present powers of local authorities, the author suggests :

1. The scheduling of the main trunk roads of the country and proclaiming them "national" roads.

2. The granting of a small annual Government contribution towards the maintenance of these roads on certain conditions regarding inspection, it being optional with the Council of each county to refuse the contribution, with the conditions attaching, if they so think fit.

3. The establishment of a small Government department, which would presumably be a branch of the Local Government Board, for the collection of statistics and other information, the publishing and distribution of such information among local authorities, the collection of samples of materials, testing, determining the relative merits of, and standardising same.

The department should also issue regulations from time to time which would ensure uniformity as far as possible in the matter of construction, width, general maintenance, etc., this uniformity varying, however, to some extent with the amount of traffic conducted over the roads and other local conditions. The department should also carefully collect particulars regarding the different methods adopted in different counties for the maintenance of the national roads, and should prepare tables setting out in detail the cost of maintaining these roads in each county, with a report from their chief inspector on their condition and the general results being obtained in each county.

4. The appointment of a chief inspector, with one or two assistants, whose duty it would be to inspect the "national" roads annually, and determine whether these roads were maintained in each county in such a manner as to entitle the local authority to the Government contribution. It would also be his duty to acquaint himself with the management and methods of maintenance in each county, to acquire information and to impart it, and generally to advise and seek to influence the local authorities and their officials to adopt the best and most up-to-date methods of road maintenance as far as such methods could be adopted in each county consistently with real and ultimate economy.

5. Investing local authorities, through the department or otherwise, with powers which would enable them to acquire land for road diversions, widenings, etc., by some easier and more simple process than at present.

DISCUSSION.

Lord CLIFFORD (Devon), referring to Mr. Shuttleworth's contention that in view of the more extensive use of the main roads which was now being made, and the steadily increasing cost of maintenance, it would not be unreasonable to ask the Government to provide a grant which would cover at least one half the annual expenditure, said he thought it would not be unfair if the entire cost were borne by the Imperial Exchequer. In his opinion the main roads should be in the hands of a central body, who would make rules applicable to the whole country, and who would have as their advisers men who would not only possess greater skill and knowledge than the ordinary county or district surveyor, but be able to deal with the subject from a broader point of view.

Mr. M. G. THORBURN (Peeblesshire) said he must admit that the paper of Mr. Shuttleworth made a very strong case for a claim on the Government for assistance in the maintenance of main roads, and he was very much inclined to agree with the last speaker that the best thing to do was for a Government department to take over the control in view of the difficulty of allocating grants. He spoke for a county with a considerable mileage of roads, but with a small population, and their highways were used by motorists from all parts of the country. At the time of the appointment of their present road surveyor 2,500 tons of metal a year sufficed for their needs, but the quantity had now increased to 20,000 tons, for which the ordinary county traffic was in no way responsible. They were in close proximity to Edinburgh and other large towns, and their roads were consequently very largely used by motors passing between these places. So a Government grant to a county like theirs might not be sufficient, and it was only by the Government taking over the

roads that they could expect to get anything like their fair share of the expense caused by this modern traffic.

Mr. W. J. FLETCHER (Dorset) said he had no reason for wishing for State control, and observed that those who were present at the Paris Congress came away convinced that it would be a wasteful system to adopt in England. He considered that no opportunity should be lost in calling the attention of the Government to the insufficiency of the present Exchequer contribution, and urging the necessity for an increase in the amount of the grants for main road maintenance. The following statistics would show how the county of Dorset had been affected by the increased cost of these roads: Acreage, 625,578; population (1901), 202,063; rateable value, March 31st, 1908, £1,205,954—a farthing rate produced £1,067. The length of rural main roads was 456 miles 5 furlongs, and that of urban main roads 53 miles 6 furlongs—a total of 510 miles. The first lumped grant being a portion of the Exchequer grant received for general county purposes for the years 1889-1890 was £14,767, and of this amount £7,444 was the contribution towards the estimated cost of rural and urban main roads for that year. The actual cost of the upkeep of these roads during that year amounted to £14,970, so that the Exchequer contribution was about 50 per cent. of the cost. The average cost of maintaining the rural and urban main roads during the five years ending March 31st last had been £50,605, and the amount received from the Exchequer grant, after deducting amounts for police, asylum, and other purposes, during the same period available for main road maintenance averaged £14,321. That showed that, although the cost of maintenance had increased by more than double, or over 40 per cent., the Exchequer contribution had decreased to 35 per cent. on actual cost, or 15 per cent. less than formerly, leaving an average sum of £5,981 per annum to be made up by the county ratepayer. Actually the loss to the ratepayers of Dorset during the 19 years had been no less than £84,137.

Mr. C. H. SCOTT PLUMMER (County Councils Association for Scotland) supported Lord Clifford in his contention that the whole cost of the main roads should fall on the Imperial Exchequer, and he would go even further and say that a portion of the expense of maintaining other roads should also be borne by the Government. But he thought it would be impossible to ask for a large contribution from Imperial sources unless there were Imperial control, and it seemed to him that the only thing to do was for the Government to take over the management and control of the main roads and give some small contribution towards the expenditure on the other roads.

Mr. H. A. MILLINGTON (clerk to the Northamptonshire County Council) said there was one matter which he would like to hear discussed. Mr. Shuttleworth had said that the case of the Lancashire County Council—which was, perhaps,

an exceptional one in some points—supplied a strong argument for a larger contribution from the national funds for general application, and he went on to point out that in the geographical county there were 18 county boroughs, or nearly one-fourth of the county boroughs in England and Wales. His own county was very different, for with the exception of Northampton there was not a single county borough within its area. What had struck him was that perhaps all the enormous traffic alluded to by Mr. Shuttleworth was local traffic between the various county boroughs, and hardly in any sense common to the whole country. It seemed to him that the figures which he gave might almost be said to be an argument for the adjustment of the present methods of Parliament in respect to the financial arrangements between counties and county boroughs.

The CHAIRMAN pointed out that that was not one of the issues raised by the papers. The point at issue was what the State was to do for their assistance.

Mr. MILLINGTON said his idea had simply been to get the experience of other counties. Although, as he had said, they had within their area only one county borough, they had running through it a number of important main roads, and he thought that afforded an argument either for a larger grant for the maintenance of those trunk roads or the taking over, at least, of some of the main roads and their conversion into national roads.

Mr. R. J. THOMAS (Buckinghamshire) said he came from a county where there was no county borough at all, so they went one better than Northampton. Dealing with the question of nationalisation, he was among those who attended the Paris Congress and inspected the far-famed national roads of France; but there seemed to be something wrong with those roads, for without question some of the highways they inspected were in a worse condition than many English roads. One road, as a matter of fact, was in such a state that the driver of a car in which he was travelling begged to be allowed to go round a side road in order to avoid the roughness of the trunk road. With reference to the subject of expenditure, in Bucks that had increased during the past eight years by £13,000, representing a county rate of 3d. They had three trunk roads passing through the county, and these bore a very large amount of through traffic, only 7 per cent of which, it had been ascertained, was Bucks traffic. It seemed that what they wanted were additional Government grants, but if they succeeded in obtaining these there must be a certain amount of Government control. That was only to be expected. If the Government decided to give these grants for the main trunk roads of the kingdom, to start with, the work could be done by the various authorities, subject to the approval of a competent engineering inspector. By that means they could get the full benefit of local knowledge and

the advantage of local prices, while the local authorities would naturally interest themselves in keeping down expenditure. There was always danger in one authority doing the work and another paying. There was no reason why a single authority should be made to pay for what were really trunk roads, and the nationalisation of trunk roads would be a very good start.

Mr. A. T. DAVIS (Shropshire) said he agreed very much with what had fallen from the last speaker, and he was quite of opinion that the time had come when the Government should pay a larger contribution towards the upkeep of main roads. He also agreed that the one who paid the piper should call the tune, and it would be necessary for the Government to provide for a certain amount of inspection. But he did not agree with Mr. Dorman that there should be a Government department set up for the collection of statistics, testing of materials, and other purposes, as that, in his opinion, would only lead to extravagance and not to economy. Where they paid taxes and rates for the upkeep of the roads they wanted to get the best work at the lowest price. That was the aim, he was sure, of all local authorities. It had been suggested that County Councils might become extravagant and careless as to how money was spent when they knew that their local rates would be unaffected. But he thought it would be quite simple to devise a plan for a contribution from the State on a basis proportionate to the mileage of the main roads, and they could then leave it to the County Councils to get the best value for their money. But to establish a State department for the testing of road stones would, as he had said, be an extravagance, because it would be impossible for the officers of the department to get a true idea of the value of all the classes of stone which were made use of. A county surveyor was better able to judge which was the best material to use under the different circumstances which arose, as he was able to take into consideration the character of the road and the amount of traffic which it was required to carry. For example, if a State department were set up, it might be decided that the far-famed Cleve Hill stone should be made use of. That would be an extravagance. The Cleve Hill stone was one of the best stones in England, but it was not necessary to use it for all the main roads in his county; that was to say, there were quarries nearer to the roads which yielded stone quite good enough for their upkeep. He was strongly of opinion that the time had come when the Government should give them an increased grant, and he trusted the Conference would strongly urge the desirability of this being done.

Mr. W. LASCELLES SOUTHWELL (chairman of the Roads Committee of the Shropshire County Council) expressed the view that some of the main roads should be scheduled as national roads, and the expenditure borne by the Government.

He was totally opposed to the Government maintaining the roads throughout the kingdom, and he was perfectly sure that it was an extravagant means of maintenance. Local management of the roads would be preferable and more economical, because the requirements of the highways would be better understood by those living in their neighbourhood. Some roads required a much better material than others.

Mr. T. B. CRIPPS (Gloucestershire) pointed out that the county which he represented had something like 1,100 miles of main roads—a much larger proportion than most counties. One speaker had asserted that if a grant were given on the mileage, those counties with the larger percentage of main roads would gain an advantage from it. But he did not think that would operate fairly. The rates in the different counties varied very considerably; for example, he believed that the rate in Lancashire was about 5d., while in Gloucestershire it was over 1s. His view, therefore, was that the most equitable arrangement would be for the grant to be made, not on the length of roads, but the rateable value. As to the question of supervision, at present, although they received grants, that was practically nil, and if increased grants from the Imperial Exchequer meant that they would be obliged to submit to additional restrictions, he thought they would be better without the money.

Mr. THOMAS said his idea was that the grants should be in proportion to the mileage of trunk and not main roads.

Mr. E. PURNELL HOOLEY (Notts) maintained that if they were to receive extra grants for the maintenance of their roads, they must certainly expect Government control in some shape or form. He cordially agreed that the time had come when there must be some help from Imperial sources, but he did not think it would do to let it be known that they were already squabbling as to how the money was to be spent. His view was that the grants should be based on road area, and not mileage.

Mr. THORBURN observed that the upkeep of the narrow roads was proportionately greater than that of the wide roads.

Mr. REES JEFFREYS (Motor Union and Roads Improvement Association) remarked that the pressure of road traffic in the different counties was most unequal; in some counties it was not felt to anything like the extent it was in those which carried the great trunk roads out of London. It was quite clear that the financial burden was becoming in the latter a very serious one, and the only practical way of adjusting the difficulty was by means of a State grant. He agreed with Mr. Hooley that the area of the road should be taken into consideration in making grants, and his view was that the traffic of the road should also be taken into account, for those that carried a great deal were clearly entitled to a larger grant than those that had only to contend with a light traffic. In France they had most excellent statistics as to main road traffic, and he had in his possession a map which

showed the traffic over every main road in that country. He thought it was agreed that the State should give them some additional contribution; but how were they going to force the hands of the State in view of the great demands upon the Imperial Exchequer at the present time?

Mr. J. L. OFFICER (Convention of Royal Burghs of Scotland) said he thought that Mr. Rees Jeffreys had struck the nail on the head in suggesting that the traffic on the roads should be taken into consideration in allocating grants.

The CHAIRMAN said that what was really wanted was that those who got the most benefit from the roads and did the most damage should bear the burden of maintaining them. Their desire was to bring the roads up to date and up to the requirements of modern traffic, and the consensus of opinion expressed that day indicated that. They wanted to save the pockets of the ratepayers who really did not get the benefit of the roads to any extent; therefore, it was absolutely necessary that they should spread the burden of expenditure over a wider area than at present. The only alternative to that was that they should take over the main trunk roads and get a considerable subvention from the State towards their maintenance. He confessed that when he came into the room he was rather in favour of nationalisation, but after consideration of the way in which French roads were looked after he was now of opinion that they would not do right to go back to the old contract system, which had been generally abandoned. His view, therefore, was that the resolution which they should put forward at the final meeting of the Congress should be framed in the sense that a larger subvention should be granted from the Imperial Exchequer towards meeting the increasing cost of trunk road maintenance.

Lord CLIFFORD said he would be quite willing to support a resolution framed in those terms.

Mr. THOMAS MUNRO (Lanarkshire) said he quite agreed that if the amount of traffic could be ascertained it would be a very fair criterion for the distribution of the grant, but he believed that as things were at present it was impossible to obtain that information. That being so, expenditure seemed to him the fairest criterion.

Mr. R. H. DORMAN (Armagh), in a short reply upon the discussion, said he attended the Paris Road Congress with the idea that he would be able to return with some new ideas on the subject of road maintenance, but what he had found was that the French roads were in a far worse condition than his own main roads, and he had felt when he had seen the men at work on the national roads that he would like to have stood over them and teach them how to do the work. He was strongly opposed to the idea of managing the roads like that.

SECTION C.

COLLECTION OF STATISTICS.

CHAIRMAN :

J. BARKER.

SECRETARY :

E. C. PEELE.

TECHNICAL SECRETARY

T. COLE.

Papers 6 and 7 were taken as read, as follows :

PAPER 6: BY SEYMOUR WILLIAMS, CHAIRMAN OF THE EXECUTIVE COUNCIL OF THE RURAL DISTRICT COUNCILS ASSOCIATION, AND CLERK TO WARMLEY RURAL DISTRICT COUNCIL.

I think it desirable that this Conference should take some action in the direction of carrying into effect the resolution of the Paris Congress to the effect that a Central Committee be formed consisting of representatives of the various associations to arrange for the collection of statistics.

Every official of a local authority knows that from time to time requests are made from all kinds of sources, both public and private, for statistical information on various heads. However willing he may be to oblige, the number of these requests is so great that it becomes impossible to comply with them without a serious tax on the organisation of his office, and in small offices it means actual expense out of his own pocket. To avoid this difficulty and overlapping, I suggest that a statistical bureau, consisting, in the first instance, of members appointed by the official associations, which should be charged with the collection and tabulation of the statistical information relating to the local government in the country, should be formed.

It will, no doubt, be desirable to invite the co-operation of associations of a non-official character, but as the constitution would be a matter of some little difficulty, and there might be differences of opinion as to whether one such association or another should be represented, the line of least resistance seems to confine the committee to representatives of the official associations, giving them power, however, to call into consultation representatives of other associations. The financial question will no doubt create some difficulty, but the thing must be started in a small way at first and can gradually grow.

If a grant be made by the associations representing the County Councils, Municipal Corporations, Non-County Boroughs, Urban

and Rural District Councils, this will be sufficient to form the groundwork upon which to work, and the sale of the publications of the Committee will probably be sufficient to meet any additional cost.

There would be no difficulty in arranging that copies of all publications could be sent to any local authority or individual who desired same on payment of an annual subscription.

My idea is not to confine the statistical information merely to roads, but to all matters relating to local government, and I imagine there is little doubt that if the bureau is worked in the right way that the Local Government Board would be willing to place at its disposal some of the statistics in its possession, a corresponding exchange being made.

I, therefore, suggest that the following resolution might be submitted to the Conference—viz. :

“That a committee, consisting, in the first instance, of two representatives of each of the following bodies—viz., the Association of Municipal Corporations, the County Councils Association, the Non-County Boroughs Association, the Urban District Councils Association, and the Rural District Councils Association—be appointed as a committee to consider the formation of a statistical bureau, and that such committee have power to call into consultation the representatives of other authorities and to take such steps as they may think proper for carrying into effect the formation of the proposed bureau.”

PAPER 7: BY G. MONTAGU HARRIS, M.A., SECRETARY TO THE
COUNTY COUNCILS ASSOCIATION.

The chief result of the International Road Congress held at Paris in October, 1908, was the establishment of a Permanent International Commission to sit at Paris to centralise the results of tests and experiments made in all parts of the world in relation to the construction, maintenance, traffic, and working of roads. The collection of information and statistics by such a body as this is comparatively simple as far as those countries are concerned which have a centralised system of road administration, but in this country under present conditions such information is practically unobtainable. The British representatives present at the Paris Congress recognised this difficulty, and accordingly, on the motion of Mr. Seymour Williams, passed the following resolution :

“That it is desirable that a Central Committee be formed consisting of representatives of the various associations to carry out the suggestion of the Congress with regard to the collection of statistics, and generally to collect and disseminate information.”

This resolution was circulated to the various associations indicated, several of which replied approving of the resolution, while others, not having the matter before them until the intention had been made known of holding the present conference, considered that this would be the best opportunity of going into the whole question of a central body for the collection of statistics.

Whatever may be the extent of the operations of the institution to be set up in Paris, no one is likely to suggest that it can obviate the necessity for a system of collecting statistics for this country.

Indeed, for the complete success of the Paris bureau, some such institution will be required in each country associated, and thus from the international as well as from the national point of view, it is most desirable that some system shall be set up.

There must be, of course, a great number of considerations in connection with this subject as to the lines upon which such statistics should be collected and drawn up, for it is most desirable that the whole matter should not resolve itself into a mere agglomeration of alphabetical pigeon-holes or tabulation of figures. The collection of statistics of this kind should be the subject of a really scientific study, and should result in the provision of information on such systematic lines as would be of real practical assistance in understanding the whole art of roadmaking, in overcoming its difficulties, and solving its problems. At present, however, it appears premature to go into this part of the question, for, before anything can be done, it has to be decided who is to do it, and the object of this paper is merely to form a basis for the discussion of that point.

It is urged in some quarters that there should be established a central road authority for the whole country. Were this idea to be carried out, it would be obvious that that authority would be the body to undertake the collection of statistics. The opposition, however, to the establishment of such an authority is so great and the inclination on the part of the central powers appears to be so small that it seems unnecessary to dwell on this solution of the problem.

It is suggested, again, by some that this function should be undertaken by the Local Government Board. To this course there appear to be at least three strong objections. In the first place, the Local Government Board has at present nothing whatever to do with roads, and, therefore, this would in no way work in with any of its existing functions. Secondly, the Board is already completely overburdened with its multifarious duties; and, thirdly, the statistics which are at present published by that Board are almost always at least two years old before they reach the public eye. It may, at any rate, be taken for granted that the authorities of the Board themselves have no desire that this duty shall be cast upon them.

As regards the professional associations of road surveyors and kindred societies, it does not appear that any one of them is in a position to undertake this for the whole country, even if the question of expense could be met, while to spread it over several of them would not in any way solve the difficulty, as some central organisation would still be required.

We come next to the various associations of local authorities, and here we are again met by the difficulty that no one of them covers the whole ground, nor, as a general rule, are their arrangements such as to lend themselves to the establishment of a statistical department. The County Councils Association of England and Wales stands in a somewhat different position from the rest, in that it is the only one which has an office and organisation entirely distinct from any other business, and that it does at present systematically collect and publish information and statistics on all matters with which County Councils are concerned. For these reasons it might be both convenient and economical to work an institution for the collection of road statistics in connection,

as far at any rate as locality of offices is concerned, with the County Councils Association, but whether this were so or not, it is clear that any such institution must be under the control of a body representative of all the interests concerned.

This, indeed, is the conclusion to which one is led—that for this purpose it will be necessary to establish a new institution, to be managed by a committee upon which will sit persons representative of the various road interests, and, as it appears most feasible to obtain such a representation through the various existing societies and associations, I would venture to throw out the suggestion that a first step should be taken by asking the various bodies represented at this Conference each to appoint a couple of representatives to form a committee to draw up a scheme for this purpose.

As regards the financing of such an institution, the simplest method would probably be for each body associated in the scheme to give a yearly subscription for establishment expenses, and for the institution to sell all publications, possibly at a lower price to members of the subscribing bodies than to the general public. These details, however, would have to be worked out by the suggested representative committee.

DISCUSSION.

Mr. R. DRUMMOND (Renfrewshire) said it appeared to him that the question of the collection of statistics was of the utmost importance, and that it was very necessary to found a bureau by which road authorities could obtain reliable information on all matters pertaining to the roads—in particular, the best methods of dealing with modern traffic. As to the nature or method of working the bureau he was not prepared to speak, but, as Mr. Harris had suggested in his paper, neither the Local Government Board nor any of the professional associations were in a position to undertake the work and do it properly. In any case, the work, to be complete, must comprise all information as regards materials, methods of application, traffic, and climatic and other conditions. In Scotland they worked under great disadvantages on account of their climatic conditions, this being particularly the case in the West of Scotland. The atmosphere was humid, and they suffered from a very large annual rainfall, which reduced their opportunities of treating road surfaces with bituminous binding. Therefore, the establishment of a properly-organised system of obtaining reliable information was of first importance; it would obviate many a road authority experimenting uselessly, and enable them to adopt an approved method right away. The standardisation of the roads was also a very important point. The raising of road surfaces to a given standard might be impossible in some districts owing to lack of funds, but he had no doubt that

these would be forthcoming sooner or later in the form of grants-in-aid, etc. As a road surveyor he deplored the present lack of uniformity in methods of road maintenance.

Mr. F. G. CARPENTER (West Riding of Yorkshire) gave his approval to the formation of the bureau proposed by Mr. Williams. He hoped it would be formed, and that it would meet with success. At the same time, he thought representatives of the County Surveyors Society should be added to those whom it was suggested should form the committee.

Lord BELPER considered that it was desirable to have statistics not only from the authorities responsible for the maintenance of the roads, but from individuals interested in other ways; that would enable the information they desired to be put before them in some systematised form, for however great an area from which they were supplied with information might be, that information was perfectly useless unless they could compare it with statistics from other parts of the country. The matter of standardisation had already arisen in another section of the Conference, where Mr. Brodie, the city engineer of Liverpool, had supplied some very valuable statistics with regard to heavy traffic in large towns. Mr. Brodie complained himself that he had selected a certain method of collecting statistics, and that other statistics were collected in a different way, the result being that they were rendered practically useless. But he ventured to say that, whether this standardisation question was discussed in another section or not, it was extremely desirable to pass a resolution in favour of the proposition put forward. The Local Government Board were not an authority on the roads, and he did not think that at present they could get them to undertake this duty. But whatever body was appointed to collect these statistics and get some standardised scheme adopted, that body should be representative of the various societies taking part in that Conference.

Mr. WILLIAMS said there could be no objection to anyone else being represented on the committee, and he had only limited the representation in the first instance to influential English associations in order to put the scheme into working order. His idea was that the committee should not be limited to collecting statistics with regard to roads, but other local government matters, and his hope was, whether the Conference deemed it wise to enlarge the number of bodies represented or not, that the proposition would be carried in some form and that it would have some practical results.

Mr. MONTAGU HARRIS (secretary of the County Councils Association) said he was sorry there were not more speakers on the subject, for although the general principle seemed to be approved, he had hoped that they would have had a more general expression of opinion as to what the meeting preferred. Mr. Williams wished to narrow the representation down to what he called the influential associations, but the local

government bodies represented only one side of the matter. They must also look at it from the purely technical point of view. Then with regard to Mr. Williams's other suggestion, that the bureau to be established should deal not only with roads, but other local government matters, that seemed an alarmingly large question, and he could not conceive that the Conference would be inclined to establish any body that would go into all local government matters. Mr. Williams must be aware of the large number of subjects dealt with by the local governing bodies. It would be an enormous undertaking indeed. Of course, it was obvious that it hardly came into the business before the Conference, but apart from that the establishment of any such institution as that was, he thought, too large for them to attempt. Moreover, local authorities had their own institutions and associations who could collect any information they required. He thought they wanted as representative a body as possible to take steps towards the establishment of a bureau, and when once that bureau was formed they could proceed to consider how this question of standardisation must be decided.

Lord BELPER remarked that he had not even considered the possibility of the proposed body dealing with all local government statistics. The Conference was called for the purpose of dealing with the management of roads only, and to open out such a very difficult and important question in the way suggested would not have the approval of those represented on it.

Mr. GEORGE WAINWRIGHT (Urban District Councils Association) said it seemed quite certain that they must restrict themselves to the question of roads. It would be most unwise to extend the functions of the bureau to other branches of local government, which had all their own associations and arrangements for the collection of statistics, and it was his hope that the resolution to be put to the Conference on Saturday morning would deal with the question of roads, and roads only.

Mr. WILLIAMS explained that his idea was that the bureau might in course of time add to its duties. The committee might have power to call into consultation any persons whose assistance might be necessary.

No paper on "Standardisation" having been contributed, the discussion on that subject did not take place.

FRIDAY, APRIL 30.

SECTION C.

LICENCES AND REGISTRATION.

CHAIRMAN :

SIR T. ROE, M.P.

SECRETARY :

H. SEYMOUR WILLIAMS.

TECHNICAL SECRETARY :

W. REES JEFFREYS.

Paper 39 was taken as read, as follows :

PAPER 39 : BY DOUGLAS LEECHMAN, MEM.INST.AUTO.ENGRS.,
ASS.INST.MECH.ENGRS., BARRISTER-AT-LAW.

In order to appreciate the position of the County Councils and motorists on the subject of motorcar registration and licensing, it is necessary to review the regulations in force. The Locomotives on Highways Act, 1896, and the Motorcar Act, 1903, empowered the Local Government Board to deal with these matters, and in pursuance thereof the Board issued the Motorcar (Registration and Licensing) Order of 19th November, 1903.

Articles I. to XIII. of the regulations deal with the *registration* of motorcars.

Article I. requires the council (*i.e.*, the Council of a county or county borough) to keep a register of motorcars, and prescribes the index mark distinguishing each council, according to a table of letters set out in the first schedule.

According to Article II., the owner of a motorcar who desires to register it shall furnish the Council with particulars of his full name ; postal address of his usual residence ; description or type of car, with the name of the maker or the name by which the type is ordinarily known ; type and colour of body of car (this is not required in the case of a motor cycle) ; weight ; unladen ; whether intended for private use, or use for trade purposes, or use as a public conveyance ; particulars as to the position on the car in which it is proposed to place the plates forming the identification mark ; together with the signature of the owner or of the person applying on his behalf, and the date of application. The registration fees of £1 for a car and 5s. for a motor cycle are in accordance with the Act of 1903.

By Article III., on receipt of such application and fee, the Council are required to assign a separate number to the car, enter it in the register, and furnish the owner with a copy of the entries.

Article IV. deals with change of ownership, and allows notice thereof to be given by either the new or the old owner, and requires an application to be made either to cancel the registration or to continue it under the new ownership. If an application is made for cancellation, the registration is to be cancelled unless an application is also made to continue, when "the new owner shall furnish the necessary particulars as to ownership"; and on receipt of a fee of 5s. in respect of a car and 1s. in respect of a motor cycle, the Council shall alter the register accordingly and furnish the new owner with a copy of the altered entries. The provisions of this article may be carried out in advance so as to take effect from the date of the change of ownership. If the provisions as to notice and application are not complied with, the registration of the motorcar is to become void.

Article V. requires the owner of the car to notify the Council of any circumstance (other than change of ownership) affecting the accuracy of any particulars respecting the car in the register. The council are to amend the entry accordingly, and furnish the owner with a copy.

If the Council are satisfied that a car on their register has been destroyed, broken up, permanently removed from the United Kingdom, or registered with another authority, or if the owner requests them to cancel the registration (except where in the case of a change of ownership there is an application to continue the existing registration), Article VI. requires them to cause the entries in the register to be cancelled, and they may, if they think fit, assign the registered number to any other car whether belonging to the same or some other owner.

Article VII. and the fourth schedule require two copies of the mark, lettered and numbered in conformity with certain diagrams and dimensions, to be painted on the car or on plates to be fixed thereto. The letters and numbers must be white and the background black.

Article VIII. directs that the plates shall be fixed on the back and front of the car respectively, so that every character is upright and easily distinguishable from in front of and behind the car respectively; but motor cycles not exceeding 3 cwt. may have a double-faced front plate which can be easily read from either side. Subject to the above provisions, the plates shall be fixed in the positions stated in the application for registration, or subsequently furnished to the Council, who, if they are not satisfied therewith, may require the plates to be fixed in such positions as they may direct. The article concludes with the remarkable provision that "so long as the provisions of this order are complied with, different identification plates may be used on a motorcar by day and night or on different occasions."

The effect of Article IX. may be stated shortly as that when another vehicle is attached in front or behind a motorcar, the whole turnout shall be treated as a motorcar, so far as the attachment of the plates is concerned.

Article X. allows the Council to supply and charge for the plates, if they think fit, and the owner so desires.

Article XI. requires the rear number plate to be illuminated between one hour after sunset and one hour before sunrise. In the case of a motor cycle not exceeding 3 cwt. the front plate may be illuminated instead of the rear one.

Article XII. relates to manufacturers' and dealers' general identification marks.

Article XIII. requires a Council, upon application by any other Council or by the police, to provide gratis a copy of the entries in the register relating to any particular car. Other persons are to be provided with such particulars on payment of 1s., and showing reasonable cause for requiring same. Inland Revenue officers may inspect the register and take copies of entries therein at all reasonable times without charge.

The second part of the order relates to *driving licences*, and Article XIV. provides that the application shall be made to the Council of the county or borough *within which the applicant resides*, and on one or other of two forms, according as the application is made for a licence or a renewal. A fee of 5s. is payable in either case, and applications may be made not more than one month in advance.

In making application for a licence, the applicant must state whether it is to be for driving a motorcar (in its inclusive sense), or is to be limited to driving motor cycles, and whether he is more than 17 or 14 years old respectively. He is also required to give particulars of any previous licences and of endorsements thereon, and of any disqualification for obtaining a licence.

Articles XV. and XVIII. specify the forms of licence and renewal and of the register of licences respectively.

Article XVI. provides for the granting of licences to applicants having no residence in this country.

Article XVII. allows the Council to issue an effective duplicate licence or renewal upon being satisfied that the original has been lost or defaced.

Article XIX. provides for furnishing other councils and the police with copies of the entries in the register of licences, and upon receipt from any court of particulars of any conviction of a driver licensed by the Council, and of the order of the Court, the Council shall forward a copy of such particulars to the police for the area where the driver resides.

Articles XX., XXI., and XXII. deal with *supplemental* matters, and provide, *inter alia*, for the exercising of the powers of the Council under the order by the clerk or other authorised officer. The Order applies in the case of a roadway to which the public have access, as well as to a public highway. The expression "motorcar" includes a motor cycle unless the contrary intention appears. Water, fuel, and accumulators used for propulsion are not to be included in calculating the weight of a motorcar or motor cycle unladen.

From the above it will be realised that the requirements the motorist has to comply with are distinctly heavy, and that taxes are exacted from him to an extent far exceeding that entailed by any other form of locomotion. He has to pay one charge for registering his car, another annually to drive it, and frequently another also annually and much larger, according to its weight. Motorists resent the imposition of fines for breaking a technical speed limit law if, as is frequently admitted by the police, no sort of inconvenience has been caused to the public, especially in view of the fact that the Royal Commission on Motorcars and the Local Government Board, not to mention other authorities, have condemned this form of extortion. It is gratifying to notice a

disposition in some quarters to discontinue these practices, which are directly opposed to the spirit of English legislation and fair play. Any condition of affairs that induces liege subjects to distrust and despise the law is always greatly to be deplored. The motorist is put to the expense of providing and fixing identification marks and of illuminating one of them at night, and all this in addition to the ordinary carriage tax and householders' rates and taxes, which include charges for the upkeep of roads.

It is not to be wondered at, therefore, that the motorist feels that he is somewhat "put upon."

The introduction of any considerable novelty into our public life is always met by a certain hostility which is apparently innate in most men. Possibly it arises from an instinctive regard for vested interests, from jealousy or covetousness. The feelings are subconscious, and by most men would either not be admitted to exist in them or would be sternly repressed if detected. Unfortunately, however, they often escape examination, and so express themselves almost unconsciously, but all too effectively; and progress in more senses, therefore, is greatly hampered. The pioneer cyclists were received with very negative encouragement, though the utility of the cycle as a health giver and as a means of rapid, easy, and convenient locomotion has demonstrated itself beyond all question. Motoring is even more important. True, it has been largely a pastime so far, but the private individual has been and is merely paying out of his own purse for the establishment on a practical footing of a means of transport even now only second to the railway, and in some respects far superior even to that.

As motoring drew off too persistent attention from the cyclist, so it is to be hoped flying will allow the motorist to pursue his way peacefully and untrammelled. If he drive unfairly, fine him, or in extreme cases impound his vehicle, but do not bleed him for offences which are such in name only, or by excessive taxation. The fees and formalities of registration and permission to drive might very well be included in those attaching to the payment of the ordinary carriage taxes.

The transfer of a number from one car to its successors under the same ownership should be allowed as a matter of right. This would not involve any loss to the Councils, as the purchasers of the old cars would have to pay the fees in the usual way. It would merely be an extension of Article V., and another indication of the toleration and the practical adoption of means to ends which are among the most promising characteristics of government of our day.

DISCUSSION.

Mr. DOUGLAS LEECHMAN (Royal Automobile Club) said it was gratifying to know that the additional taxes which were to be imposed on motors were to go to the improvement of the roads—which was, of course, the great object of the Conference.

Mr. W. LASCELLES SOUTHWELL (Salop), referring to

Article XI. in the paper, which requires the rear number plate of a motor vehicle to be illuminated one hour after sunset and one hour before sunrise, expressed the view that that ought to be altered so as to read "sunset" and "sunrise" after the word "between." He took particular note during the past winter that on foggy or very dull days it was quite impossible to read the numbers of cars passing through a town at a fast pace; at such a time it was out of the question to see the numbers an hour before sunset, and there were no means of detecting offenders against the speed limit.

A delegate here pointed out that in the North it was practically broad daylight an hour after sunset. They might, however, arrange that the time of lighting should be when the sun was 18 deg. below the horizon—though he did not suggest that that was practicable.

Mr. LEECHMAN pointed out that even if they were able to adopt the latter arrangement, it would be rendered inoperative by fog. They might, however, make a distinction between summer and winter.

ROAD SIGNS.

Papers 27 and 28 were taken as read, as follows :

PAPER 27 : BY C. W. S. CRAWLEY, R.A.C., M.I.E.E.

1. *Suggestion for promotion of uniformity in erection under the present Act.*
2. *Alterations that appear to be desirable when the Act is next revised.*

The Act of 1903, Section 10, lays on the local authorities the duty of erecting danger signs at dangerous corners, cross-roads, and precipitous places, and the County Councils Association and Municipal Corporations Association arranged a system of danger-posting under that Act, which was approved by the Local Government Board.

The scheme, where properly applied, works fairly well, but it is often very widely departed from. The natural result of this want of uniformity is to deprive the signs, even when properly erected, of most of their usefulness; as their meaning entirely changes when passing from one district to another.

Where they are well done it is generally because the county or other surveyor takes them under his own charge, and sees that they are properly placed; but they often appear to be left in quite incompetent hands. Some authorities, however, although they collect the licence fees which were given them to pay for the signs, refuse to erect any at all. Others refuse to erect them at any place, however dangerous, that is not on a main road.

The original rules of the Associations are :

1. "Notices to be on near-side of road, facing the driver."

This is fairly obvious, but where not supervised by the surveyor is by no means always obeyed, with most confusing results.

2. "Notices to be 50 yards from danger spot."

Subsequent experience shows that this distance was on the short side; 100 yards would have been better. I would ask surveyors, even if they consider it not to be feasible to change their triangles to 100 yards, to at least see that none are less than 50 yards distant from the danger spot. In some cases they are actually *at* the spot, and this makes it far more dangerous instead of safer.

3. "They are to be not less than 8 ft. high."

To these I would add for consideration the following:

The back of the sign should be preferably white—never red; it is, at times, most confusing.

The background should be considered. A red tiled roof, a copper beech, or similar background, often makes a sign invisible. Open sky (or a white wall) is the best, and can often be got by putting the sign a few yards further back.

Signs should be kept for really dangerous spots and not put at every cross-road. Cross or joining roads are generally visible some way off. If signs are put for those that are not dangerous, they are disregarded when they really mean danger.

Where signs are really wanted:

1. At blind cross-roads. Where the cross cannot be seen till the driver is close to it; for example, when it is hidden by a bend in the road or by high hedges, and similar cases.

2. Where a village begins suddenly round a corner. (Not very frequent.)

3. Where a road crosses or joins another on a hill. (No triangle required below the cross-road as a rule.)

4. For very steep hills.

5. Hill less steep but beginning immediately after a turn in the road.

The following points are suggested for amendment in future legislation:

(A) At present should any authority refuse to erect proper signals there is no means of obliging them to do their duty.

It is suggested that an appeal shall lie to the Local Government Board, who shall be bound to send an inspector to inquire into any complaint, signed by three householders in the district, regarding improper or insufficient signals, should the local authorities refuse to rectify or erect them. The inspector to have power to order their erection or alteration. Provided that with such appeal there shall be deposited the sum of (?) £20. If the appeal succeed, the entire time and expenses of the inspector to be paid by the local authorities and the deposit returned. If the appeal fail, the same to be paid out of the deposit, and also a sum of (?) £1. 1s. to the local authority for their representative's time and expenses: and the balance returned. Conveyance to points of inspection to be provided by appellants, and several smaller points would have to be dealt with. This should most effectually prevent frivolous appeals on the one side, and on the other the mere fact that such an appeal can be made will in many cases attain the desired end without one being actually carried through.

(b). It is proposed that when one road joins or crosses another signals must be placed (when required) on the less important road only; *never* on both. When there is any doubt which is the less important road the question to be left to the surveyor's discretion.

In case of any accident occurring at a junction thus posted, the vehicle issuing from the posted road to be statutorily liable for all damage to any other vehicle or to anyone or anything else.

Several advantages accrue from this.

First—and least—half or one-third of the triangles are required at a point.

Second. The traffic of the more important road is not retarded, while that on the smaller one has only to do what it ought to do at present—but so often neglects to do—viz., to see the main road is clear before it joins or crosses it.

Third and greatest. It ensures the triangle being obeyed. Under the present rule, a careful driver who sees a triangle knows there is also one on the other road, and expects the other man to slow down, too; while the reckless one leaves the other man to do all the slowing down, and if there is an accident throws half the blame on him for having also passed a triangle without slowing down enough. Under the proposed rule a driver, when he sees a triangle, will know for certain that there is *not* one on the other road he is joining, and that if any accident occurs he will not only have to pay his own repairs, but those of everyone else. This is a risk that the most reckless driver will be very loath to take.

(c). Unofficial Signs. There are so many such signs erected on roads that they have become a positive nuisance in some places. Leave to erect them is given by many authorities as a matter of course, and the permission has been very much abused. I would suggest that surveyors should satisfy themselves in each case that the sign is really wanted, or else refuse the application; and, if already erected, should have it removed.

(d). I would suggest that any new Act shall make it an offence to erect either on public or private ground any sign purporting to caution the traffic on any highway, except in the case of the duly appointed authority, or of persons holding their permission in writing for each sign so erected.

(e). Also that it should make it an offence to deface, injure, or interfere with any sign duly erected for the purpose of controlling the traffic. (The small boy and the hooligan find them excellent marks for stones, and want stopping.)

I would suggest as signs which might generally be authorised, those requesting horn-silence when passing places of worship on Sundays, or hospitals. Occasionally they are justified for schools, when these abut right on to a road or are just round a corner.

They are also useful for places of quite exceptional danger where the red triangle is insufficient.

Two points more:

1. In considering the necessity of erecting a sign it is well to look at it from the point of view of a man who is coming to it *for the first time*. He is, or should be, the only one who incurs danger or causes it. A corner or a steep hill, which is no danger whatever to the local man who knows it, may be a very serious one to a stranger who does not.

2. In nearly every surveyor's territory there is a branch of the Royal Automobile Club, and he will always find it only too glad to give any assistance not only with regard to signs but in any other road matters in its power.

PAPER 28: BY A. T. DAVIS, M.INST.C.E., F.S.I., COUNTY SURVEYOR OF SHROPSHIRE, AND PAST-PRESIDENT OF THE INCORPORATED ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS.

Milestones.—By the General Turnpike Act of 1822 turnpike trustees were required to provide and maintain milestones. The Highway Act of 1835, however, contains no similar provision, but power is given to highway authorities to incur expense in maintaining, replacing, or setting up milestones on any highway by the Highway Rate Assessment and Expenditure Act of 1882.

Milestones are generally to be found on the main roads of this country. The inscriptions on many of these, however, have become almost, if not quite, illegible, and in such a condition they are, of course, practically useless as indicators of the distances to the principal towns, and serve only to mark the measured mile.

Where distances are marked, as they should be, on the direction posts set up at road junctions, milestones are not so much needed; nevertheless, travelling is made more interesting along roads on which the latter are still kept up. Being fixed at regular intervals, they serve at least to indicate the speed at which one is travelling.

There are some curious anomalies to be found as regards inscriptions on milestones—*e.g.*, some 400 yards from the place in which I am writing an old corner milestone at the junction of two main roads (one of which is the road from London to Holyhead) gives the distance to London as 159 miles, while a more modern milestone not far away states it to be 150 miles. At first I accounted for the discrepancy by supposing the engraver to have mistaken the figure nought for a nine, but on closer investigation I arrived at the conclusion that the distance stated on the older stone was the route by Oxford instead of that by Coventry, which was the more recent mail-coach route between London and Shrewsbury.

It is puzzling to find out in a town the point from which the distances given on some of the old milestones were measured. Sometimes they were taken from the centre and sometimes from the outskirts of the town.

It is not, however, always at the starting point that one is perplexed. It is sometimes at the termination. Here is an instance: The main road from Shrewsbury to Ludlow passes through Church Stretton, and the milestones on the northern section are marked from Shrewsbury, while those on the southern section give the distances from Ludlow. Now it happens that the thirteenth milestone from Shrewsbury is situated in Church Stretton, and so also is the fifteenth milestone from Ludlow, but these two stones are about half a mile apart, so that travellers are frequently confused in making their calculations, and are half a mile, at any rate, out of their reckoning.

I could mention similar anomalies, but suffice it to say that many of the old milestones are unreliable, and I am bound to confess that I have hesitated to incur expense in maintaining or replacing them for that reason. If it is deemed desirable to continue this method of indication, the old stones should be revised and readjusted on a uniform basis.

The most convenient form of milepost is the angular one of cast iron, with the name of the town towards which a traveller is going inscribed in raised letters, and the distance in figures on the side facing him. The old illegible milestones can generally be restored by affixing thereto a plate, either of cast iron with raised inscription, or of wrought iron on which the inscription can be painted. Unfortunately, enamelled plates form too tempting a target for the stone thrower.

Signposts.—The authority for setting up sign or direction posts is derived from Section 24 of the 1835 Highway Act, which enacts that: "The surveyor is to erect or fix in the most convenient place, where two or more ways meet, a stone or post with inscriptions thereon in large legible letters, not less than 1 in. in height, and of a proper and proportionate breadth, containing the name of the next market town, village, or other place to which the highways respectively lead."

These are the most useful signs we have on our roads, especially when they give the mileage as well as the direction, which, I regret to say, is not a universal practice.

In ancient times these friendly road signs were mostly made of wood, but now the old wooden posts are gradually being superseded by posts of cast iron, and in many cases the arms are of cast iron too, although some highway authorities prefer wooden arms, as in Shropshire.

In designing the Shropshire post I endeavoured to make it as simple as possible, so that ordinary road labourers could fix it. With this object in view, I provided the head of the cast-iron post with eight slots to receive the wooden arms, and this number has proved amply sufficient to suit the angles of the different road junctions usually met with. The principle I have generally followed in deciding the inscriptions has been to indicate the nearest village or villages, and the next town or towns; but no hard-and-fast rule can be laid down—each case must be considered on its own merits. One frequently finds the preposition "To" before the names, and an index-finger at the other end. These, however, are superfluous, and occupy space which might be better utilised by bolder lettering.

The mileage to each place should always be stated at the end of the name. This need not be expressed in smaller fractions than $\frac{1}{2}$, and the word "miles" is quite unnecessary. The lettering should be as bold as possible.

Each post should be fixed in such a position as to be, as far as practicable, visible from all the converging roads. There are thousands of guide posts which do not answer this description. The best position for a direction post at the junction of a side road is on the opposite side of the road from which the side road branches, and not at one of the angles formed by the latter. As a rule, a post so placed would be seen from all three directions. There is generally more difficulty in finding a good position in the case of cross-roads, and sometimes the conditions are such as to

render such a post obscure from perhaps one of the converging roads; nevertheless, every effort should be made to render these important road signs as conspicuous as possible.

With the object of guiding its members along a particular route—*e.g.*, London to Holyhead—the Royal Automobile Club, with the permission of the several highway authorities, is erecting special signposts or attaching special arms to existing posts, showing, in bold letters, “London” on the one hand and “Holyhead” on the other, with their distances. These special arms are of cast iron, 2 ft. 8 in. by 9½ in., with ¼ in. letters. So far as Shropshire is concerned, the expense of fixing and maintenance is being borne by the club.

Danger Signals.—Under the Motorcar Act, 1903, Section 10 (2), County Councils and Town Councils of boroughs with a population of more than 10,000 are empowered to erect signposts denoting dangerous corners, cross-roads, and precipitous places where such sign posts appear to them to be necessary, subject to regulations as to size and colours to be made by the Local Government Board.

With a view to uniformity of action, the County Councils Association and the Municipal Corporations Association, after consulting the County Surveyors Society and others, recommended to the Local Government Board the adoption of the under-mentioned signs:

1. “For 10 mile or lower limit of speed, a white ring, 18 in. in diameter, with plate below, giving the limit in figures.
2. “For prohibition, a solid red disc, 18 in. in diameter.
3. “For caution (dangerous corners, cross-roads, or precipitous places), a hollow red equilateral triangle, with 18-in. sides.
4. “All other notices under the Act to be on diamond-shaped boards.

“All such notices to be placed on the near side of the road, facing the approaching driver.

“All notices under Section 10 (2) of the Act to be fixed at about 50 yards from the spot to which they apply.

“The underside of the sign to be not less than 8 ft. from the ground level.”

These recommendations received the approbation of the Local Government Board, who in their circular letter to the councils, dated March 10th, 1904, expressed the opinion that they might conveniently be adopted, and if carried out it would be unnecessary for them to issue regulations on the subject.

Unfortunately, the permissive character of Section 10 (2) of the Act has materially militated against the uniformity aimed at, for although five years have elapsed since the Act came into force, some authorities have not considered it necessary to erect any warning signs at all, while others have done so with too lavish a hand.

Automobile clubs and societies are freely distributing signs of their own design, and owners of property abutting on the roads are erecting signals in their hedge banks to guard their carriage drives, or to protect villages and hamlets in which they happen to be particularly interested. Surely this irregular, irresponsible, and wholesale erection of danger signs is a grave danger, in that it is conducive to motorists, and other road users generally, to ignore them altogether. It is quite time a halt was called, and

the Government urged to insist on absolute uniformity, both as regards type of warning sign and mode of erection.

These signs should only be set up by, or with the knowledge of, the responsible local authority, and then only on certain lines to be prescribed by the Local Government Board. In this connection I offer the following suggestions for consideration :

For caution, I would have one sign only—viz., a hollow equilateral triangle with 20-in. sides (the present 18-in. triangle is, in my opinion, a little too small). It should be painted bright red on the side facing the approaching driver and white on the reverse side. The underside of the symbol should not be less than 8 ft. from the ground level. It should be erected not less than 70 yards, and not more than 100 yards, from the first point of danger (there are frequently several points of danger near together) and on the left-hand side of the road to anyone approaching that point. It should have the best possible background for visibility, preferably a sky background.

It may be urged that one sign is insufficient, inasmuch as it does not indicate to the driver the kind of danger he is to guard against, and that there should be a distinct symbol for each different category of danger ; but in my opinion simplicity, and not multiplicity, is the essential qualification, for however wide these categories were made there would still arise in practice other unforeseen and equally important cases unprovided for.

Let the driver, on coming to a red triangle, drive with special caution until he has passed out of the danger zone indicated by the second triangle, which in this case will be on his off-side, and painted white ; and, what is equally important, let the police and public insist on it.

The signs should only be erected where real danger exists and special caution is required. Motorists would then learn to respect them, instead of treating them with the contempt which familiarity is now leading them to do.

An ordinary curve in the road should be approached by a driver on the assumption that there may be an obstruction round the corner. In like manner, in approaching cross-roads or side roads which are clearly discernible owing to a conspicuous direction post, or, better still, to the transparency of the corner fences, he should drive in such a manner as to avoid coming into collision with any traffic that may issue therefrom ; and the public are entitled to ask the police to enforce careful driving in all such cases without warning symbols. When the curve, however, is exceptionally sharp or of a special character, or the cross or side roads are concealed from view, and a direction post is not visible, then special caution is necessary, and danger signals should be erected. Similarly, a steep descent (save, of course, one of exceptional gradient) which is clearly visible for some distance requires no warning sign, but when it is of such a character that a vehicle comes upon it suddenly round a turn or curve there is real danger, and a warning post should be set up.

County Councils are constantly being urged to provide warning signals for the entrances to towns and villages. In my opinion this is absolutely unnecessary ; surely motorists in driving through inhabited places need no injunction to exercise caution. The notice board so frequently to be seen at the entrance to a town politely requesting motorists to drive slowly is equally

unnecessary, so long as it is an offence against the Act to drive "at a speed, or in a manner, which is dangerous to the public."

In the case, however, of a village school, which is not recognisable as such, special warning is, perhaps, desirable. This can be met by affixing to the ordinary warning post, just below the triangle, a plate with the word "School" marked thereon.

The recognised signs for limited speed, prohibition, and other notices under the Act appear to answer their purposes fairly well.

DISCUSSION.

Mr. CRAWLEY, supplementing his paper, said he was glad to find how thoroughly Mr. Davis, the county surveyor of Shropshire—the author of the next paper on the agenda—was in agreement with the view he had expressed. It was a very great nuisance, indeed, to have these irregular signs all over the country, and his view was that, if they required to be put up, the County Councils should be responsible for the work. The county surveyor of Berkshire had supplied him with a copy of the signs which were being fixed there. The authorities were very firm on the point, and would not have any other kind. The type in question was that of the ordinary red triangle, and they had about 400 of them in different parts of the county, and about 485 signs altogether. A careful record was kept of the exact spot where the sign was to be found, and every one was noted on a map.

The CHAIRMAN: The triangle is open?

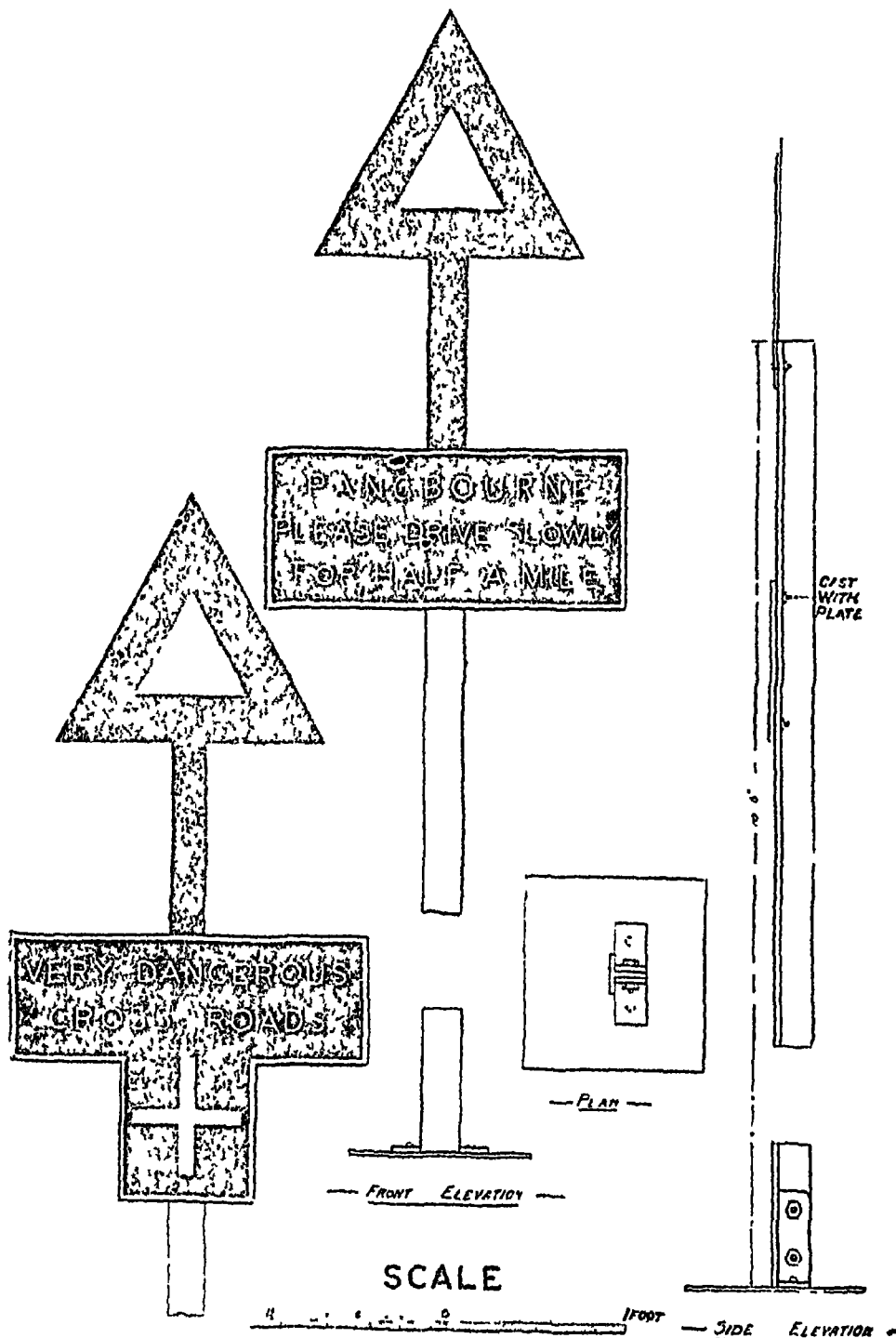
Mr. CRAWLEY: Yes. There were a few villages where they had fixed notices, "Please drive slowly for half a mile"—a courteous request which was complied with. In very exceptional cases they had a sign on which a cross was added, and these signs cost 7s. 6d., and 9d. a year for painting. But they were not put up where they were not really wanted. It was found that the signs were well obeyed, and were appreciated, because the names of the villages were shown on them. There was, however, one suggestion he would like to make. It was often a difficulty to know when one was out of a danger zone, and his idea was that they might adopt what had been done at a place in Wales, where a large sign with the words, "Thank you," had been put up by the authorities to denote this.

The CHAIRMAN inquired whether the plates would offer any resistance to the wind. At Buxton they took the form of sky signs in order that the wind would not blow the post down.

Mr. A. T. DAVIS (Shropshire) said that, as a result of his long study of the question, he had arrived at the opinion that one sign put up in absolutely dangerous places where special

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caution was required was all that was necessary, and if they multiplied those signs they ran the risk of motorists disregarding them. On the other hand, if they could get uniformity throughout the country, motorists would know when they saw a red triangle the necessity for caution. At cross-roads, where the finger post was clearly visible, a special danger sign was not required. He wanted the Conference to press the Local Government Board to take cognisance of this subject, and issue regulations prohibiting the putting up of these signs by all and sundry, and make it a *sine quâ non* that they should be erected only by responsible persons. He thought the Conference would lose a splendid opportunity if they did not frame a resolution to that effect. Then there was the difficulty of mile posts. In some places they were conspicuous, and the figures properly kept up, but in others, although the mile posts might be there, the inscriptions were illegible. In his paper he had laid stress on the idea of sign-posts being used as danger signals. A committee of his Council had been inquiring into this very question, and they were of opinion—although they had not yet finished their labours—that direction posts should be used as danger signals in the case of side and cross roads.

Mr. REES JEFFREYS said he was very much in sympathy with some of the views expressed by Mr. Davis, but he was not quite at one with him in some of his conclusions. He had served a long apprenticeship in this question of road signs, and had now come to some very decided opinions with regard to it. He thought the ordinary red triangle did not receive the attention that it ought to do. There was one reason for that. It was the experience of all Continental touring bodies that any sign that did not indicate the exact nature of the danger to be met was not much use, and he agreed with that. The method of indicating the danger was in some pictorial form. For example, they had usually a straight line to mark an ascent, two crossed sticks to mark a dangerous crossing, five bars to indicate a level crossing, and so on. There was, however, a certain reason for adopting these pictorial signs, and that was the number of different nationalities represented by those using the roads. He thought the red triangle must be written down as a failure, because of the inadequate nature of the warning it gave, and because it was erected in an indiscriminate manner. The Roads Improvement Association had issued some thousands of signs, and, with some few exceptions, they had been erected by the local authorities, who, he agreed, were the proper people to carry out the work. As a result it had been possible to get some kind of uniformity. They never issued signs unless they saw a plan of the place and consulted the local surveyor. Mr. Crawley had pointed out in his paper that there was no power to compel an authority to erect danger signals, and in order to get uniformity it should be possible for some central authority to require the local bodies to carry out the obligations imposed

on them by statute. The Act was very precise up to a certain point; it said they "shall" erect, but adds, "where it appears to them to be necessary." The result had been that one County Council had gone to the length of refusing to erect any signs at all. He thought it was not the intention of Parliament that Section 10 should be carried out in that way. So the new central department which was going to administer the grants motorists were to find should have a voice in the matter as to where signs should be erected. Not only was there no power to compel the erection of signs in places where they were necessary, but it was impossible to obtain the removal of signs from points where they were unnecessary. Mr. Davis had concluded his paper with the statement that the recognised signs for limited speed, prohibition, and other notices under the Act appeared to answer their purposes fairly well, but he absolutely traversed and denied that. It was not the case, although it might be the case in the county which he represented. The existing signs in villages were absolutely useless, for they were frequently hidden from view, and were of no value in marking the 10 miles speed limit.

M. ALBERT MAHIEU, engineer of roads and bridges, Paris, and secretary of the Permanent Commission of Road Congresses, pointed out that the recent International Congress on Roads had decided upon the limitation of road signals to four types—the first to denote ordinary obstacles, the second railway level crossings, the third cross-roads, and the fourth dangerous turnings. (See Appendix C.)

Mr. W. LASCELLES SOUTHWELL (Salop) observed that the authority which he represented had given great attention to the question of symbols, and one great point in their progress was to be that of uniformity. Their experience was that the fewer signs there were the better it was. They were very well provided with finger posts in Shropshire, and they were having these altered so that they could be seen clearly from the different roads converging upon them. They kept their fences as low as possible, and they found that landowners were generally willing to assist them in that respect. Although they did not want unduly to multiply symbols, they were of opinion that the proximity of schools should be clearly indicated. Another point was that the signs should be kept well painted, otherwise it would be next to impossible to read them, and motorists would find them a considerable nuisance. At present symbols were placed too near the danger zone; they ought to be put further back, and he agreed, also, that motorists should be able to know when they were out of the danger zone. He thought it should be absolutely illegal for anyone to erect symbols without proper authority.

Mr. M. G. THORBURN (Peeblesshire) said he thought it was quite evident from the discussion that uniformity of signals was a necessity. At the same time it was clear that they could not expect to get uniformity without additiona

legislation. They were also agreed upon the point that no one outside the County Councils or other road authorities should have power to put up notices, for the reason that their multiplication tended to affect their usefulness. He considered, also, that no signals should be erected unless there was real danger, and if the nature of the danger, when it existed, could be indicated clearly without any great expense it would help to make the signals of much more value.

Mr. DOUGLAS LEECHMAN, referring to Mr. Crawley's contention that in case of an accident occurring at a posted road the vehicle issuing from that road should be statutorily liable for all damage, said he agreed with the principle of that, but thought that the writer of the paper went too far. In his opinion the onus should be on the person coming out of the side road. Coming to Mr. Davis's paper, he should like to urge a point—namely, the systematic erection of signposts. It was the practice in some places to paint the name only on one arm of the signpost, but the signpost was sometimes so close to a corner that one was liable to pass it and to find that the reverse side gave no information at all. The different arms on a post, also, should be erected at different levels, and with cross-roads he did not think it was necessary to economise so far as to have all the arms on one post. Why not have two posts, or even three? On the much-discussed question of danger signals, he agreed that uniformity was one of the essentials of the whole matter, and if they could arrive at a standard the signs would receive a great deal more attention than they did at present. But some signs were so unnecessary at the present time that one lost respect for them, and did not appreciate those in well-ordered regions. The object of a sign was to indicate specific danger, and unless that danger was apparent when one saw a sign, the only logical conclusion was that the sign should tell one where the danger was, for the real danger might be obstructed from view. As to the erection of these very important signals at the commencement of a low speed limit, he thought it was almost impossible to make a reasonable sign to indicate that, because, when motorists came to a place more or less difficult owing to the traffic, they gave every attention to the traffic and could not look out for signals.

Mr. SEYMOUR WILLIAMS (Rural District Councils Association) said it would be gathered from the remarks of M. Mahieu that the Paris Congress had come to the conclusion that danger signals should be limited in number to four, but Mr. Davis in his paper supported the view that one was sufficient. He was afraid that Mr. Davis was singular in that respect. On the other hand, one did not want unduly to multiply the number of signals for fear that they would be disregarded. As to the question of milestones, in France there was quite a compendium of information on these, so much so, in fact, that it had been decided that it was necessary

to put a limit on the information. Then came the question of mileage. Some persons measured from the outskirts and others from the centre of a town, confusion being the inevitable result. Therefore, some standardisation of the method of measuring was desirable. However, he thought they might be able to agree upon the course he had recommended—namely, that the whole matter should receive very careful attention in the light of the experience that had been gained.

The CHAIRMAN observed that Mr. Davis and Mr. Crawley appeared to be somewhat agreed upon general lines, but held different opinions as to the number of danger signs. He took it, however, that it was the general feeling that the number should be as small as possible.

Mr. CRAWLEY said it had been objected by the representatives of Shropshire that two signs were unnecessary, but he thought they would admit that in some places, at all events, one was not enough. He thought it was a fact that there were some places where special treatment was required. The village sign he did not look upon as a nuisance, but as a distinct convenience. The ordinary red triangle had not received attention, but if put in suitable positions it would not be disregarded.

Mr. DAVIS said he had noticed that a number of speakers had disregarded the important suggestion that there should be only one sign. He was sorry for that, because he thought the meeting had not quite realised the point he had raised in his paper—namely, that there should be a danger zone, and that if a danger signal was put up only where there was absolute danger motorists would know the meaning of the triangle when they came to it. It did not matter whether it was a cross-road, a bend, or a dangerous declivity coming round a bend, so long as a triangle was put up.

Mr. REES JEFFREYS: Who is to settle where there is real danger?

Mr. DAVIS: I should have that settled by a code of regulations drawn up by the Local Government Board, and I think you can quite depend upon the County Councils to carry out these with ability and reasonableness. He hoped the meeting would pause before passing any resolution in favour of indicating the nature of the danger. There might be two kinds of signs—one a red triangle, warning the motorists to drive cautiously, and the other a white one, outside the danger zone. He considered that several of the signs referred to by the French delegate were not necessary. The level crossing, in his opinion, should be marked by the railway company. Many of these level crossings were clearly visible, but where that was not so he would have a red triangle set up. He did not quite know what was meant by the "obstruction" which was provided for by another sign. Was it some opening in the road for sewerage or water? If so, it would be only temporary in character. Regarding Mr. Rees Jeffreys's remarks, where motorists were unable to

see the signs, it was because those signs were not properly fixed.

Mr. REES JEFFREYS: In a place like Brentford the only way one could see a sign would be for the sign to be stretched *right across the road*.

Mr. DAVIS (continuing) said the matter was one that should be dealt with by local authorities, and local authorities only. He did not agree with the idea of signs being issued by the Motor Union, though he agreed that a much better sign might have been adopted. He would be disposed to support a resolution of the nature suggested. In his view it was unnecessary to put up danger signs at the entrances to villages, because when one came to inhabited places one naturally drove slowly. Then they had to remember that the posts were comparatively frail structures, and that an extra plate would offer increased resistance to the wind. If they had the sign at all, he would put it on a different post altogether.

SATURDAY, MAY 1.

PLENARY MEETING.

CHAIRMAN :

THE RT. HON. LORD BELPER.

SECRETARY :

G. MONTAGU HARRIS.

TECHNICAL SECRETARY :

T. H. B. HESLOP.

DISCUSSION.

The CHAIRMAN said they had now got to the stage for trying to arrive at a decision on the resolutions that had been sent up by the chairmen of the different sections as expressing the sense of the discussion at those sections. Those resolutions had been approved, and would be submitted to the Conference. Of course, there were only a limited number of resolutions, as they were aware it was decided not to submit resolutions on a matter respecting which there was contention and a great difference of opinion. He need only add that every member of the Conference would have a vote if there was a division taken, and that it was competent to have amendments moved with the understanding that those amendments were submitted to the Chairman and approved by him. The first resolution stood in the name of Mr. Tonman Mosley. Before asking him to move it, he would like to point out that the resolution which stated the desire that the increasing cost of trunk road maintenance should be partly met by increased Exchequer grants somewhat clashed with Resolution No. 10, which was moved as the result of discussion in one of the sections. He, therefore, thought it desirable that those two resolutions should be taken at the same time and discussed together. They might then arrive, perhaps, at some solution which might be satisfactory to the whole Conference. He, therefore, asked Mr. Tonman Mosley to postpone his resolution until they got to No. 10.

A representative stated that Mr. Mosley was not present.

Standardisation.

Colonel DIXON moved: "That it is desirable that a system of standardisation should be established to facilitate the collection and dissemination of all information in regard to roads and the traffic thereupon."

Mr. PLATT (Rochdale) seconded, and the motion was carried unanimously.

Tar.

Colonel DIXON moved: "That the use of tar or other adhesive matter for the construction of roads is desirable, especially in regard to motor traffic." That, he said, covered a large field, for it meant making the roads or laying the roads, or anything.

Mr. WAKELAM (Middlesex) seconded.

Mr. DRUMMOND (Renfrewshire) moved to amend the motion, so that it should read: "That the use of an adhesive compound for the construction and maintenance of roads," etc.

Mr. HOGG (Elgin) seconded the amendment, but it was agreed by a large majority that the word "tar" should stand part of the resolution.

Colonel CROMPTON moved to leave out the words "adhesive matter" and insert "or other waterproofing material."

Colonel DIXON accepted the amendment.

The resolution, as amended, was adopted as follows: "That the use of tar or other waterproofing material for the construction of roads is desirable, especially in regard to motor traffic."

Damage to Roads.

Colonel DIXON moved: "That road authorities should have power temporarily to prohibit traffic of heavy vehicles on their roads on the break-up of frost, or in other special cases where serious damage would be likely to result."

Mr. NICOL (Aberdeen) seconded.

Mr. ANDERSON (Lanarkshire): Is usual traffic to be accounted heavy traffic?

Colonel DIXON: Any traffic which the surveyor might think would hurt his roads.

The CHAIRMAN said, as he understood the resolution, it was for the purpose of dealing with very extraordinary times, when the sudden break-up of a frost would cause such enormous damage to be done on a road that, if this heavy carting or traction work were allowed to go on, in a few hours it would cause hundreds of pounds' worth of damage. He knew cases of that sort. It was quite clear that some discretion should be given to the road authority to prevent that, and that the ordinary law as to getting the approval of the Local Government Board was quite useless in the case of a sudden break-up of the frost, and the inconvenience that an individual might be put to would not be anything like that of the construction of a road within a short time.

Mr. WHYATT (Grimsby) pointed out that in districts which were rather low-lying the roads were often saturated, the frost might break up in the morning, and he did not think it would be possible to send out notices to team owners and others. The suggestion was impossible, unless they had placards issued and already prepared.

Colonel DIXON said it was only intended for heavy and exceptional traffic.

Mr. MONCUR (Staffs) thought the resolution should read: "That road authorities should have power to prohibit temporarily."

The resolution as moved was carried by a large majority.

Dirt on Highways.

Colonel DIXON moved: "That it should be made an offence punishable by law negligently to permit soil, mud, or dirt to be brought upon the highway by the wheels of vehicles."

Mr. DAVIS (Shropshire) seconded.

Mr. LAMBIE opposed the resolution, because he thought the ordinary law was sufficient to meet the case.

Mr. HOGG described the resolution as ridiculous, and quite impracticable.

Sir H. FAIRFAX-LUCY hoped the resolution would be withdrawn, for it seemed to him it would be open to a great deal of misrepresentation throughout the agricultural counties.

Colonel DIXON said he had only to voice what he considered the feeling of the meeting over which he had presided. That meeting was certainly in favour of a resolution such as he had moved.

Mr. HUTCHINS (Montgomeryshire) regarded it as impossible to deal with this evil at present.

The resolution was declared carried by 103 to 25.

Weights on Vehicles.

Colonel DIXON moved: "That further regulations are desirable in regard to the weights permitted to be carried upon all classes of vehicles, and that such weights should be based upon considerations of width and type of tyres, diameter of wheels, and speed."

Mr. GRAFTON (Cheshire) seconded, and the resolution was carried unanimously.

Statistical Body.

Mr. T. COLE, on behalf of Mr. J. Barker, moved: "That the following bodies represented at this Conference be each asked to send one representative to attend a meeting for the purpose of drawing up a scheme for the establishment of a central body to collect statistics and to publish information with regard to roads and vehicles, and that the Secretary of

the Conference be requested to take the necessary steps to carry out this resolution :

County Councils Association of England and Wales.
Association of County Councils in Scotland.
Association of Municipal Corporations.
Non-County Boroughs Association.
Urban District Councils Association.
Rural District Councils Association.
Convention of Royal Burghs.
Association of Municipal and County Engineers.
County Surveyors Society.
Institution of Civil Engineers.
Institution of Mechanical Engineers.
Surveyors Institution.
Scottish Road Surveyors Association.
Association of Surveyors in Ireland.
Royal Automobile Club.
Motor Union.
National Cyclists Union.
Roads Improvement Association.

Mr. SEYMOUR WILLIAMS seconded, and hoped the resolution would be carried into effect immediately.

Mr. STURMEY said the Society of Motor Manufacturers and Traders were represented, but they were not in the list, and Mr. SHRAPNELL SMITH said that was the case, also, of the Commercial Motor Users Association.

The SECRETARY (Mr. G. Montagu Harris) explained that it was thought the list drawn up included all the bodies represented here, although not directly. It was thought the bodies mentioned would be represented through the Automobile Club and the Motor Union ("No"), but if there were other bodies which were not included in the list who would like to have representation, it might, perhaps, be as well that they should communicate with him, as secretary of the Conference, and he would put it before the Committee at their first meeting.

Mr. LAMBIE supported the resolution.

The CHAIRMAN said the resolution was only for the purpose of appointing a small committee, and he did not think there would be any jealousy between the bodies. The object was to get a business-like committee.

The resolution was carried unanimously, with an amendment, moved by Sir A. BUCHAN-HEPBURN, "That the committee be given power to add to their number."

Road Classification.

Sir H. FAIRFAX-LUCY, Bart., had upon the paper to move Resolutions 8, 9, and 10. They were: (8) "That the roads for the maintenance of which County Councils are responsible should be classified under two heads—viz., primary and secondary." (9) "That this classification should be undertaken by one of the Government departments in consultation

with the County Councils." (10) "That the Government should contribute the whole of the cost of the 'primary' roads subject to such roads being maintained to their satisfaction, and that this contribution should be in addition to the grants at present received from the Exchequer." He explained that he proposed to be allowed to alter No. 10, and No. 1 had considerably helped him in the wording he would like to propose. He would like to move: "That, in the opinion of the Conference, the maintenance of primary roads should be more largely met by increased grants from the Government, subject to such roads being maintained to their satisfaction." He believed that the primary roads would cost the local authorities very much more in the future than they had done in the last few years. This extra grant of £600,000 would really add to the expense of the County Councils rather than diminish their expenditure, because he supposed these roads would become the main arteries of traffic, and £600,000 would be a mere flea-bite for the purposes which Mr. Lloyd George outlined in the House of Commons. County Councils did not care about having any interference from Government departments. He thought they should not give the Government department concerned an opportunity of riding off on the plea that the local authorities would not object to any supervision or inspection over their work. If they asked for increased grants, to which they were certainly entitled, it would be only diplomatic if they said in plain language that they were willing and agreed that the roads should be maintained to their satisfaction. He moved Resolutions 1 and 10. The first resolution was: "That, in the opinion of the Conference, it is desirable that the increasing cost of trunk road maintenance should be partly met by increased Exchequer grants."

The CHAIRMAN said that Sir H. Fairfax-Lucy wished to substitute for Resolution 10: "That, in the opinion of the Conference, the maintenance of primary roads should be more largely met by increased grants from the Government, subject to such roads being maintained to their satisfaction." That, he took it, was very much the spirit of Resolution No. 1, but, of course, whoever was here to move or speak to Resolution No. 1 would be able to express his opinion as to whether that covered the ground.

Mr. SEYMOUR WILLIAMS said Mr. Mosley, who had put down Resolution 1, was not able to be present, and he had asked him to move it. If the suggestion of Sir H. Fairfax-Lucy were adopted, it would exclude urban roads maintained by Urban Councils from the purview of the resolution.

The CHAIRMAN felt bound to say that he did not think that was correct. The County Councils would include county boroughs, and these were the boroughs that would have the management.

Mr. SHUTTLEWORTH (Lancashire) expressed his wish to move Resolution No. 1, with the substitution of "main" for "trunk."

The CHAIRMAN said he had been asked by Sir H. Fairfax-Lucy to say that he wished to meet any difficulty in regard to the way in which the clause was at present worded, and he would suggest that No. 8 should read that all main roads should be classified under two heads, and that No. 9 should read, that this classification should be undertaken by one of the Government departments in consultation with the local authorities concerned.

Lord CLIFFORD said it was understood at the meeting respecting Resolution 1 that there was a distinction to be drawn between existing main roads and trunk roads.

On the Chairman putting Resolution No. 8,

Mr. COWAN (Irish Works Department) said that in many counties there were no main roads at all. It seemed to him that they would lose nothing and keep themselves safe by a slight alteration in language, stating that it should be a proper selection of main roads.

Mr. FRANK (Ripon) thought Resolution 8 would act very unfairly upon all parts not county boroughs, because it was generally known that the main roads went a certain portion of the way into a borough and terminated, and then there were main roads on the other side of the borough.

Mr. REES JEFFREYS inquired how they were going to meet in this case certain district roads which were in the nature of trunk roads, but were not technically main roads. He instanced the Great North road.

The CHAIRMAN thought there was considerable force in the suggestion, but the only thing he could suggest was that there should be some words like this: That there should be a reclassification of all the principal roads in the country, and then go on to say that there should be a class of primary roads or trunk roads for which a large portion of the cost should be paid by Government. He thought that would meet the difficulty.

Sir H. FAIRFAX-LUCY intimated that if his words were not clear, he would accept any that would make them clearer.

Mr. HORTON (Derbyshire) offered to second the amendment suggested by Mr. Shuttleworth—the substitution of “main” for “trunk.”

Mr. REES JEFFREYS suggested that Resolutions 8 and 9 should form one resolution, as follows: “That the classification of roads be undertaken by one of the Government departments in consultation with the local authorities, and all the principal roads classified under two heads—namely, primary and secondary.”

Mr. DRUMMOND seconded the motion, which was accepted by Sir H. FAIRFAX-LUCY.

This amendment was carried unanimously, and the motion was carried as a substantive resolution.

Sir H. FAIRFAX-LUCY moved: “That, in the opinion of the Conference, the cost of maintenance of primary roads should be more largely met by an increased grant from the Govern-

ment, subject to such roads being maintained to their satisfaction."

Mr. COWAN seconded.

Mr. SHUTTLEWORTH moved, in Resolution 1, the substitution of "main" for "trunk." He said the proportion of contributions from Exchequer sources did not amount to anything like the proportion that occurred when these charges were cast on the County Councils, nor did it amount to the proportion that was recognised, as a performance of national services in the maintenance of main roads, by the Royal Commission on Local Taxation appointed in 1901.

Mr. HORTON (Derbyshire) seconded, regarding this as a proper sequence. Resolution 1 should stand as No. 1.

The CHAIRMAN thought there had been some confusion. They had agreed to a resolution which said that all roads should be classified and divided into two divisions, and if they went back and passed a resolution with regard to main roads, and then went on to subdivide, it was either doing again what they had done or not doing it in a correct way. It was pointed out that there were other roads which it might be necessary to make into primary roads besides main roads, and, therefore, they were undoing what they had already done if in No. 1 they were endeavouring to substitute "main" for "trunk." However, he would put the resolution which Sir H. Fairfax-Lucy had substituted for Resolution No. 10, and anybody who objected could vote against it.

Mr. SEYMOUR WILLIAMS said that, in the absence of Mr. Mosley, the responsibility for Resolution 1 had been put in his hands, and Mr. Shuttleworth was proposing to undo what was the expressed wish of the particular section.

Mr. LAMBIE moved the deletion of the words, "subject to such roads being maintained to their satisfaction."

Sir A. BUCHAN-HEPBURN seconded the amendment, and said it was quite open to the Government themselves to put in such a proviso if they were not satisfied with the local authorities.

Mr. BERRYMAN appealed to the Conference not to accept the amendment. It was a well-known principle that representation should go with taxation, and if they now suggested that the general body of taxpayers should provide money for the roads without representation it would be said that they only wanted their money.

Mr. SHAND thought the difficulty might be got over if they substituted the words "subject to such inspection as the Department may think best." (Cries of "No, no.")

Earl RUSSELL said he would like to point out that they could hardly say they were expressing no opinion about whether this grant should be subject to Government supervision or not, because they would be passing an amendment withdrawing the words now before them. It was a usual thing when people granted money that they should exercise some control over the manner in which it was spent, and not

hand it over without conditions, even to local authorities, to spend, and he thought the prospect of getting this grant—if there was such a prospect—would be likely to be imperilled if it was known that this Conference directly rejected the exercise of any supervision or control being exercised over it.

Mr. WAKELAM (Middlesex) said he had been asked by the County Surveyors Society to say that they were not adverse to supervision by the Government if any grants were made. They thought that the method should be left entirely to the Government without any invitation on their part from this Conference.

Mr. HARPUR (Cardiff) supported the amendment. He remarked that the Local Government Board was constantly putting further duties on and showing greater confidence in the local authorities, and would be quite justified in sanctioning grants without establishing a huge new department with a number of inspectors, which would probably swallow up a large portion of the money voted.

Mr. A. PAYNE doubted whether it would be wise of them to ask the Government to pay a larger portion of the cost of road maintenance without supervision.

Mr. REES JEFFREYS asked the Conference not to look at the matter from the point of view of sentiment, but from the point of view of making it easy for the Government to give the money.

Sir H. FAIRFAX-LUCY hoped the Conference would retain the words. No greater disservice, he said, to the agricultural ratepayers throughout the country could be done than by eliminating them.

Mr. COWAN took it that the real object was to get better roads and as cheaply as possible. Nobody doubted that the local control in some places was excellent, and that the county surveyors of England were fit to make excellent roads if they got the chance; but they did not get the chance. And what had happened with regard to the Government grants in past years was that the Government grant was less, and the money went elsewhere than intended ("No"), with the exception, perhaps, of Lancashire. He was sure the Local Government Board did not desire to waste money or time, but it was very important to secure that the best method should be generally applied, and that they should prevent the allocation of grants going wrongly. It might be that inspection would become merely formal. In some counties in England he was sure it would not be necessary, but in certain counties it might be necessary and beneficial.

The CHAIRMAN thought the Conference would be wise if they kept the words in. These resolutions referred especially to roads which were to be supported largely by the central authority; and it seemed to him they would make a mistake in showing jealousy of supervision if that supervision was necessary. He had not the slightest hesitation in saying that if a Government authority chose to come down

and inspect the roads in his county, they would be only too happy.

The amendment was defeated by 83 to 61.

On the motion that the substantive resolution be adopted, Mr. SHUTTLEWORTH again moved in Resolution 1 that the word "main" be substituted for "trunk."

The CHAIRMAN pointed out that it would be absolute nonsense if the amendment were inserted.

Mr. HORTON seconded.

After further discussion, in which Mr. SEYMOUR WILLIAMS, Mr. SCOTT PLUMMER, Mr. DAVIS, Mr. WAINWRIGHT, and Mr. MUNRO took part, the amendment was defeated, and Sir Henry Fairfax-Lucy's motion was carried.

Consolidation of the Law.

Sir H. FAIRFAX-LUCY moved: "That the time has arrived when the highway law, after being amended, should be codified and consolidated."

This was carried unanimously.

Extraordinary Traffic.

Viscount VALENTIA moved: "That all disputed claims for damages for extraordinary traffic should come before a special tribunal—whose decision should be final—to be appointed in each case by the Local Government Board, and to consist of two county or borough engineers and a legal representative."

Mr. DAVIS (Salop) seconded.

Colonel CROMPTON suggested the insertion of the words "or other" before "engineers."

Mr. SIMEY moved that the words "county or borough" should be left out.

Mr. GOWAN seconded.

Viscount VALENTIA accepted the amendment, and suggested that the word "qualified" should be inserted. This was agreed to.

Earl RUSSELL considered that there would be difficulties as to procedure with a special tribunal. It would be better to refer the matter from the Court to a special tribunal appointed by the Court.

Sir E. JOHNSON-FERGUSON stated that the Sheriff's Court was satisfactory.

Sir A. BUCHAN-HEPBURN moved that the words "in England and Wales" be added after "traffic," and this was agreed to.

Mr. HUTCHINS moved to insert the words, "include one qualified road engineer."

Mr. HARPUR seconded.

The amendment was lost.

The resolution, as amended, was adopted.

Road Signs.

Mr. SEYMOUR WILLIAMS, in the absence of Sir T. Roe, M.P., moved: "That the whole question of danger signals, milestones, and other road signs needs revision with a view to the adoption of some uniform system throughout the country."

Mr. SCOTT seconded.

The resolution was agreed to.

A motion by Mr. BLAIR, "That the matter be referred to the central body to be appointed," was also agreed to.

Motor Taxation.

Sir A. BUCHAN-HEPBURN, Bart., moved: "That the Conference express general approval of the proposals of the Chancellor of the Exchequer in regard to the future contributions of motorists' taxation, and are of opinion that, in the event of a central authority being established, provision should be made for the due representation thereon of the local authorities." He was glad to say that a representative of the *Morning Post* — to whom they were very much indebted—had seen the Chancellor of the Exchequer, and obtained from him a definite statement as to what was intended, and with their permission he would read it. The Chancellor of the Exchequer said: "The new authority will be purely an authority to dispense money. We do not propose to set up a road department. We simply say 'we approve' or 'we disapprove,' or suggest alterations, and say, 'If you meet our views we shall be able to make you a grant of so much.' The local authority will send in a scheme saying, 'We are going to improve our roads. At the present moment they are very dangerous, because they are narrow, the curves are sharp and numerous, and we propose to widen and straighten the road; we have got to buy land for the purpose, we have got to incur a good deal of expense, we have got to improve the metalling of certain roads, and so forth. The scheme will cost so much. What grant will you give us?' We shall then consider the scheme and make up our minds, just as the Light Railway Commissioners make up their minds now as to what grants they will recommend. There is no interference contemplated with the work of the road authorities; the initiative will be entirely theirs, and if the County Council does not choose to effect any improvements it will get no grant. But our new road authority cannot interfere." He thought they would all agree that that was a most satisfactory solution. The form in which the motion stood was the best they could make out of the expression of opinion. He thought the motorists had spoken in a most generous and self-sacrificing way in regard to the new impost put upon them. They had practically all expressed approval of it to the extent that they were willing to undergo sacrifices

if the money to be derived from it was spent on the benefit of the roads for their improvement.

Mr. LAMBIE seconded.

Mr. REES JEFFREYS asked whether this Conference was concerned as to how the Chancellor of the Exchequer got the money. What they were concerned about was to get a grant from him, and need they go out of their way to express any opinion as to how the right honourable gentleman derived his revenue. He did not think it was fair to motorists to say that they approved the intention of the Chancellor of the Exchequer that they should contribute out of the Imperial revenues to the improvement or construction of roads. He moved: "That the Conference express general approval of the proposals of the Chancellor of the Exchequer to contribute directly out of Imperial taxation to the improvement and construction of roads, but is of opinion that the amount placed at the disposal of the central authority for this purpose should be increased by Exchequer grants derived from other sources."

Mr. MORESBY WHITE seconded the amendment.

The amendment was rejected.

On the motion that the resolution be adopted,

Earl RUSSELL said he objected to any tax upon motorcars or other vehicles that was imposed on the ground that they did damage to the roads. The principle of taxing vehicles because they used the roads was in many cases an obsolete principle, and it was a retrograde step. The particular proposal of the Chancellor of the Exchequer, so far as it regarded the tax upon petrol, was grossly unjust.

After further discussion, in which Colonel CROMPTON, Mr. J. L. OFFICER, Mr. BEAUMONT, and Mr. MORESBY WHITE took part, the motion was agreed to, with the substitution of the word "allocation" for "contributions," and as amended was passed with one dissentient.

Votes of Thanks.

Colonel CROMPTON proposed and Mr. THOMAS seconded a vote of thanks to Lord Belper, and Mr. REES JEFFREYS, in supporting the motion, expressed thanks to the County Councils Association for having called the Conference.

The CHAIRMAN, in replying, said they had got something to show for their three days' sittings, and the result of the meetings of the Conference was much larger than was shown by the resolutions. He was glad that they had present M. Albert Mahieu, secretary of the Permanent International Association of Road Congresses.

On the motion of Colonel DIXON, seconded by Mr. SHUTTLEWORTH, a vote of thanks was passed to the Institutions of Civil Engineers and Mechanical Engineers, and to the Surveyors Institution.

RESOLUTIONS PASSED.

1. That the following bodies represented at this Conference be each asked to send one representative to attend a meeting for the purpose of drawing up a scheme for the establishment of a central body to collect statistics and to publish information with regard to roads and vehicles, and that the Secretary of the Conference be requested to take the necessary steps to carry out this resolution :

County Councils Association of England and Wales.
 Association of County Councils in Scotland.
 Association of Municipal Corporations.
 Non-County Boroughs Association.
 Urban District Councils Association.
 Rural District Councils Association.
 Convention of Royal Burghs.
 Association of Municipal and County Engineers.
 County Surveyors Society.
 Institution of Civil Engineers.
 Institution of Mechanical Engineers.
 Surveyors Institution.
 Scottish Road Surveyors Association.
 Association of Surveyors in Ireland.
 Royal Automobile Club.
 Motor Union.
 National Cyclists Union.
 Roads Improvement Association.

And that this body have power to add to their number.

2. That the classification of roads should be undertaken by one of the Government departments in consultation with the local authorities, and that all the principal roads should be classified under two heads—viz., primary and secondary.

3. That the cost of the maintenance of primary roads should be more largely met by increased grants from the Government, subject to such roads being maintained to their satisfaction.

4. That the time has arrived when the highway law, after being amended, should be codified and consolidated.

5. That it is desirable that a system of standardisation should be established to facilitate the collection and dissemination of all information in regard to roads and the traffic thereupon.

That this motion be referred to the central body proposed to be established.

6. That the use of tar or other waterproofing material for roads is desirable, especially in regard to motor traffic.

7. That road authorities should have power temporarily to prohibit traffic of heavy vehicles on their roads on the break-up of frost, or in other special cases where serious damage would be likely to result.

8. That it should be made an offence punishable by law

negligently to permit soil, mud, or dirt to be brought upon the highway by the wheels of vehicles.

9. That further regulations are desirable in regard to the weights permitted to be carried upon all classes of vehicles, and that such weights should be based upon considerations of width and type of tyres, diameter of wheels, and speed.

10. That all disputed claims for damages for extraordinary traffic in England and Wales should come before a special tribunal (whose decision should be final), to be appointed in each case by the Local Government Board, and to consist of two qualified engineers and a legal representative.

11. That the whole question of danger signals, milestones and other road signs needs revision with a view to the adoption of some uniform system throughout the country.

That this resolution be referred to the central body proposed to be established.

12. That the Conference express general approval of the proposals of the Chancellor of the Exchequer in regard to the future allocation of motorists' taxation, and are of opinion that in the event of a central authority being established provision should be made for the due representation thereon of the local authorities.

APPENDIX A.

PRESIDENT OF THE CONFERENCE :
THE RIGHT HON. LORD BELPER.

COMMITTEE :
COL. G. DIXON, *Chairman*.

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|-------------------------------|-----------------------------|
| SIR HICKMAN B. BACON, BART. | THE RT. HON. HENRY HOBHOUSE |
| GODFREY BARING, M.P. | E. PURNELL HOOLEY. |
| J. BARKER. | W. HURST. |
| J. A. BRODIE. | J. HUTTON. |
| RICHARD BROMLEY. | C. T. LANE. |
| COL. W. E. BRYNER. | THE RIGHT HON. LORD LEIGH. |
| J. W. WILLIS BUND. | E. H. LISTER. |
| BROMLEY CHALLENGER. | E. C. PEELE. |
| H. HAMPTON COPNALL. | A. H. SCOTT, M.P. |
| A. DRYLAND. | J. SHUTTLEWORTH. |
| SIR HENRY FAIRFAX-LUCY, BART. | W. V. K. STENNING. |
| H. STAFFORD GUSTARD. | SIR WILLIAM VINCENT, BART. |
| G. R. HARRIS. | GEORGE WAINWRIGHT. |
| H. SEYMOUR WILLIAMS. | |

SECRETARY :
G. MONTAGU HARRIS.

MEMBERS OF THE CONFERENCE :
Acock, C. G. S., County Surveyor, Devonshire.
Adams, T., Wolverhampton.
Aitken, J. M., Dumfries County Council.
Aitken, Thos., County Surveyor, Cupar, Fife.
Alexander, P. D., Renfrewshire County Council.
Allin, C. J. Fox, Borough Surveyor, Smethwick.
Anderson, J., Lanarkshire County Council.
Anderson, R. S., County Surveyor, Peebles.
Anderson, Walter V., City Engineer, Winchester.
Anglo-American Oil Company, Limited.
Asher, A. G. G., County Clerk, Midlothian, Secretary to the
Association of County Councils in Scotland.
Ashurst, W. H., Oxfordshire County Council.
Ashton, Alderman, Southport.
Aspell, J., Lancashire County Council.
Atkinson, T. R., Berwickshire County Council.
Aveling, T. C., Royal Automobile Club.

- Bacon, Sir H. B., Bart., County Councils Association.
 Bagnall-Wild, Captain R. K., Royal Automobile Club.
 Baker, C. E., Secretary, Non-County Boroughs Association.
 Balfour, G., Jun., Royal Automobile Club.
 Ballantine, W., Surveyor, Stirlingshire County Council.
 Ballantyne, Sir H., Peeblesshire County Council.
 Barker, J., West Riding County Council.
 Baxter, J. W., Road Surveyor, Lanarkshire County Council.
 Bayliss, T. R., Worcestershire County Council.
 Beal, E. J., Essex County Council.
 Beaumont, W. Worby, Royal Automobile Club.
 Bell, William, Road Surveyor, Aberfeldy ; Scottish Road Surveyors Association.
 Belper, The Right Hon. Lord, Notts County Council ; County Councils Association.
 Berry, C. R.
 Berryman, F. H., Somerset County Council.
 Bidwell, C., Isle of Ely County Council.
 Bigwood, E. J., Worcestershire County Council.
 Birkby, Alderman, Bradford.
 Blair, W. N., Borough Engineer, St. Pancras.
 Blake, H. T., Limmer Asphalte Paving Company.
 Blount, B., Royal Automobile Club.
 Board, W. J., Town Clerk, Rotherham.
 Boulnois, H. P., London.
 Bowen, H. W., County Surveyor, West Sussex.
 Bowen, John, Borough Surveyor, Reading.
 Bradley, A. W., Borough Engineer, Bury.
 Breadalbane, The Marquis of, Perthshire County Council.
 Brierley, J. W., Borough Surveyor, Richmond.
 Briggs, Gerald, The Ceiriog Granite Company, Limited.
 Bristowe, Fred, Westminster.
 Brodie, J. A., City Engineer, Liverpool.
 Brodtmann, Paul, London.
 Bromley, R., Clerk to the Flintshire County Council.
 Brookes, A. E., County Surveyor, Cornwall.
 Brown, Arthur, City Engineer, Nottingham.
 Brown, Councillor W., Brighton.
 Browne-Ffolkes, Sir W. H., Bart., Norfolk County Council.
 Bryning, W. G., County Surveyor, North Riding.
 Bull, H. F., County Surveyor, Cheshire.
 Bund, J. W. Willis, Worcestershire County Council.
 Burkitt, J. P., County Surveyor, Enniskillen ; Secretary to the Association of County Surveyors in Ireland.
 Bute, The Marquis of, Buteshire County Council.
 Buttemer, R. W., Royal Automobile Club, West Surrey Branch.
 Butterworth, A. R., Highways Protection League.
 Cain, T.
 Callen, T., Road Surveyor, Haddingtonshire.
 Campbell, A. H., Borough Engineer, East Ham.
 Campbell, K. F., Borough Engineer and Surveyor, Huddersfield.
 Carpenter, F. G., County Surveyor, West Riding.
 Carler, E. W. A., Deputy City Surveyor, Gloucester.
 Catchpole, Albert A., Lee, S.E.
 Challenor, Bromley, Rural District Councils Association.
 Chambers, S. H., Surveyor, Hampton Urban District Council

Chance, Sir W., Bart., Godalming.
 Chancellor, Councillor, Richmond.
 Chapman, H. T., County Surveyor, Somerset.
 Chapman, W. A., Road Surveyor, Lanarkshire County Council.
 Clark, J. A., Ayrshire County Council.
 Clarke, Peter, Surveyor, Haddingtonshire County Council.
 Clarkson, T., Society of Motor Manufacturers and Traders.
 Clarry, W. A. H., Borough Surveyor, Sutton Coldfield.
 Clee Hill Granite Company.
 Clifford of Chudleigh, The Right Hon. Lord, Devon County Council.
 Cockburn, C. E. S., Derbyshire County Council.
 Cole, T., Secretary to the Association of Municipal and County Engineers.
 Collen, W., County Surveyor, Dublin.
 Collier, Councillor, W. E., Reading.
 Collinge, T. P., Borough Surveyor, Mansfield.
 Collins, T. Hunt, Notts County Council.
 Cooper, C. H., Borough Engineer, Wimbledon.
 Copnall, H. Hampton, Clerk to the Notts County Council.
 Cowan, P. C., Chief Engineer, Local Government Board for Ireland.
 Crawley, C. W. S., Royal Automobile Club.
 Cripps, F. W. B., Gloucestershire County Council.
 Crompton, Lieut.-Colonel R. E. B., C.B., Royal Automobile Club.
 Crowder, Samuel, Twickenham.

Dallas, J. M., Mann's Patent Steam Cart and Wagon Company, Limited.
 Darbshire, C. H., Carnarvonshire County Council.
 Darbshire, H. W., Penmaenmawr.
 Darwin, W. E., Hants County Council.
 Davies, E., District Surveyor, Bucks.
 Davis, A. T., County Surveyor, Salop.
 Dawson, P., Royal Automobile Club.
 Dawson, W. H. S., City Engineer, Bradford.
 Day, Charles, Borough Surveyor, Chatham.
 Dean Coverack Quarry Company.
 Denison, Colonel, Notts County Council.
 Dexter, Alderman, Birmingham.
 Dixon, Colonel G., Cheshire County Council; County Councils Association.
 Dixon, Roden, Borough Surveyor, Stratford-on-Avon.
 Donaldson, G., Road Surveyor, Kirkcaldy.
 Dorman, R. H., County Surveyor, Armagh; Association of County Surveyors in Ireland.
 Drummond, Robert, President, Road Surveyors Association of Scotland.
 Dryland, A., County Surveyor, Surrey; President, County Surveyors Society.
 Duckham, A., Royal Automobile Club.
 Dunning, Councillor W., Mayor of Rochdale.
 Dutfield, T., Monmouthshire County Council.

Eachus, G. Eades, Engineer and Surveyor, Edmonton Urban District Council.
 Eddowes, W. C., Borough Surveyor and Waterworks Engineer, Shrewsbury.

Elce, William H., Borough Engineer, Bacup.
 Estcourt, Councillor, Sheriff of Gloucester.
 Evans, A. O., Denbighshire County Council.
 Evans, E., County Surveyor, Carnarvonshire.
 Evans, J. H., District Surveyor, Watford ; Institution of Municipal Engineers.
 Evans, Samuel, County Surveyor, Flintshire.

Fairfax-Lucy, Sir H. W. R., Bart., Warwickshire County Council.
 Farrington, W., Surveyor, Woodford Green Urban District Council.
 Ferard, C. A., Berks County Council.
 Fidler, Alfred, Borough Engineer, Northampton.
 Finlay, Colonel A., Bucks County Council.
 Finnimore, B. K., Government of India.
 Firebrace, C. W., Dover.
 Firth, Councillor, Leeds.
 Firth, Dr. C., Royal Automobile Club.
 Fletcher, W. J., County Surveyor, Dorset.
 Forbes, A., Road Surveyor, Dunfermline.
 Forbes, A. H., Surveyor, Saffron Walden Urban District Council.
 Forster, Councillor H., Newcastle-upon-Tyne.
 Foster, J. F., General Superintendent, South Park Commissioners, Chicago.
 Fowlds, Walter, Borough Surveyor, Keighley.
 Fox, S. F. L., Borough Surveyor, Luton.
 Frank, T. Pierson, City Surveyor, Ripon.

Gammage, J., Borough Surveyor, Dudley.
 Gardner, Councillor, Coventry.
 Garrett, J. H., County Surveyor, Worcestershire.
 Gay, F. Elie, Assistant Borough Surveyor, Bath.
 Gee, Alderman, Huddersfield.
 Gibb, Richard, Lanarkshire County Council.
 Gibbon, Lieut.-Colonel J. A., R.E., Farnborough.
 Gibbons, J. S., Gloucestershire County Council.
 Gibson, James, Road Surveyor, Renfrewshire.
 Gladwell, A., Surveyor, Eton Rural District Council.
 Goodchild, C. S., West Suffolk County Council.
 Goodden, Colonel J. R. P., Dorset County Council.
 Goodwillie, T., Fifeshire County Council.
 Goodyear, Alderman W. H., Smethwick.
 Gordon, H. E., Renfrewshire County Council.
 Gowan, E. J., Rural District Councils Association.
 Grace, H. J., Enderby and Stoney Stanton Granite Company.
 Grafton, F. F., Cheshire County Council.
 Greatorex, Albert D., Borough Engineer, West Bromwich ; Association of Municipal and County Engineers.
 Greenland, Alderman G., Newport.
 Greenwood, Councillor T., Todmorden.
 Grimshaw, J., Outdoor Superintendent, Manchester.
 Gullan, H. F., City Engineer, Belfast.
 Gustard, H. Stafford, Clerk to the Monmouthshire County Council.

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Tasker and Sons, Limited.
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Yabbicom, T. H., City Engineer, Bristol.
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Younger, W., Dumfries County Council.

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APPENDIX C.

DANGER SIGNALS

Adopted at the International Conference of the 1st December, 1908, by Touring Clubs, Automobile Clubs, and other Touring Societies in conformity with the resolutions passed by the First International Road Congress.

List of Societies which have accepted the four danger signals.

The Automobile Clubs of

| | |
|--------------|-----------|
| France. | Norway. |
| Belgium. | Austria. |
| Spain. | Italy. |
| Germany. | Hungary. |
| Portugal. | America. |
| Holland. | Roumania. |
| Switzerland. | Denmark. |

Egypt.

Fédération des Automobile Clubs Regionaux de France,
comprising 33 distinct Associations.

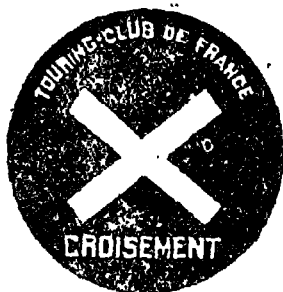
Association Générale Automobile of France.

Union Vélocipédique of France.

Touring Club of Italy.

National League of Belgian Chauffeurs.

Union Vélocipédique of Spain.



CROSS ROADS



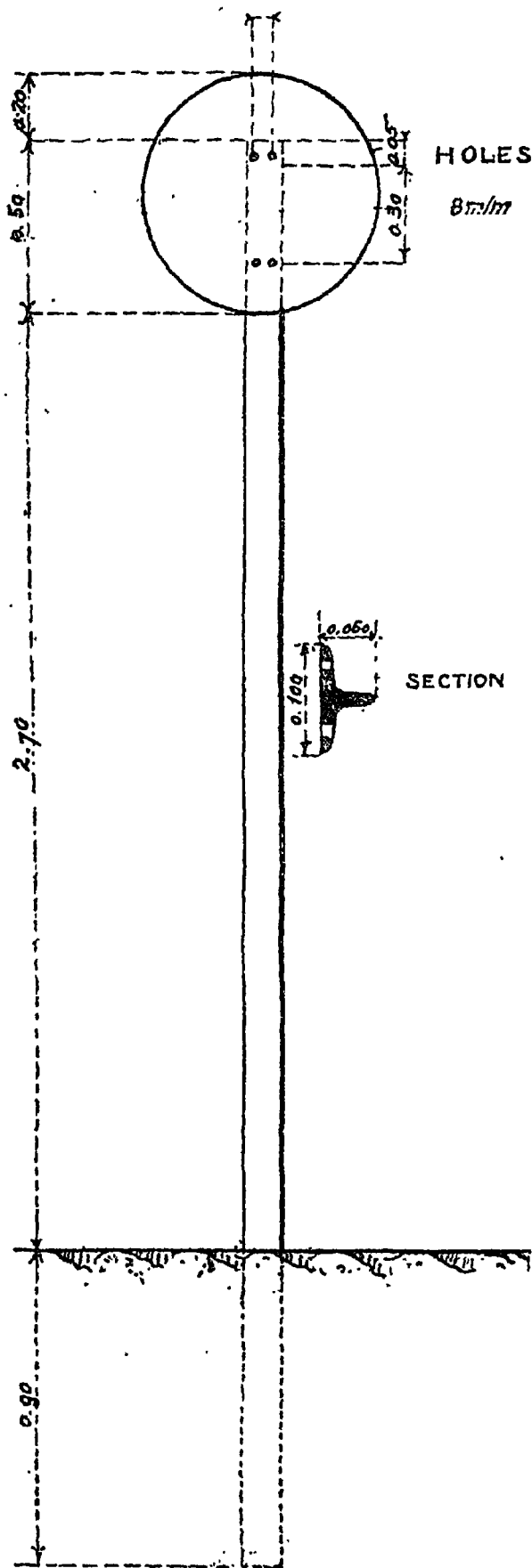
LEVEL CROSSING



HILLOCK



CORNER



LONDON :

BIGGS AND SONS, 139-140, SALISBURY COURT, FLEET STREET, E.C.

1909.
